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ENERGY GOALS ACT OF 1991

HEARING

BEFORE THE

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

ONE HUNDRED SECOND CONGRESS

FIRST SESSION

ON

S. 1018

TO ESTABLISH AND MEASURE THE NATION'S PROGRESS TOWARD GREATER ENERGY SECURITY

JULY 18, 1991

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ENERGY GOALS ACT OF 1991

THURSDAY, JULY 18, 1991

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The committee met, pursuant to notice, at 3:15 p.m. in room SD-366, Dirksen Senate Office Building, Hon. Jeff Bingaman, presiding.

OPENING STATEMENT OF HON. JEFF BINGAMAN, U.S. SENATOR FROM NEW MEXICO

Senator BINGAMAN. The hearing will come to order.

Today the Energy and Natural Resources Committee is to hear testimony on S. 1018, the Energy Goals Act of 1991. I want to thank the chairman for permitting this hearing to take place.

I believe the legislation we are considering today is critical to the development of a workable national energy policy for the country. Despite hundreds of energy bills that been introduced in both Houses of Congress, there has been little discussion of what our energy policy is supposed to do. What this legislation is aimed at is trying to correct that deficiency. This bill, which is the Energy Goals Act of 1991, attempts to answer the question in a concrete fashion.

In my view until we do answer that question and until the country has reached a consensus as to what we are about with respect to energy, it will be very difficult to agree on what steps need to be taken to get the job done.

Goal-setting is a regular tool in policy making, not just in the public sector but in the private sector. It's the first step for determining appropriate policy measures. For example, the President and the Governors have in the last year and a half established very concrete and quantitative goals for education. By the year 2000, they want to ensure that our high school graduation rate is at least 90 percent, that U.S. students rank first in the world in math and science achievement, and a variety of other concrete accomplishments they want to be able to point to by the year 2000.

These are unambiguous and measurable goals. It's clear what is intended to be achieved, and then policy options, of course, can be evaluated in terms of whether they contribute to that goal or do not. I believe we need the same kind of thing in the area of energy policy.

Unfortunately, when it comes to energy policy, efforts to establish concrete goals for energy policy have met with tremendous opposition and suspicion, particularly by the administration. When we look at the administration's National Energy Strategy, much of which I find commendable, we find very vague objectives. Lack of specific goals makes evaluation of our energy policy options difficult and makes the formulation of an effective overall strategy impossible.

The Energy Committee, under the very able leadership of the chairman, has spent the last several months wrestling with very complex and sometimes politically divisive issues involving various aspects of energy policy. These issues will have to be resolved before we can have a comprehensive and a coherent energy policy.

I agree with the logic that requires an omnibus energy bill because effective energy legislation cannot be done piecemeal.

While committee Members have agreed on many aspects of the chairman's bill, there are some highly controversial provisions, which I am sure will generate a substantial amount of debate on the Senate floor.

I am not sure what Congress will do, but one of the reasons why I think we will have difficulty finding our way is that we have not reached a consensus on what our energy legislation is intended to accomplish.

I would like to take a moment to point out what this Energy Goals Act is not. It is not a replacement for title III dealing with energy targets of the Energy Security Act of 1980. That title, I would note, is intended to be repealed under the Johnston bill. But this is very different.

The goals laid out in S. 1018 are intended to be specific enough to define a destination without dictating a path to get there. That is, the specific policy measures that would need to be achieved are not dealt with this in this S. 1018. It attempts to define goals and leave it at that.

The Energy Goals Act is not a global warming bill. The potential environmental consequences of increased carbon dioxide emissions are acknowledged, but the bill contains no specific CO2 reduction goals.

S. 1018 I think does try to reduce CO_2 emissions to the extent practicable, while the scientific question of how much those CO_2 emissions would have to be reduced is still under investigation.

[The prepared statements of Senators Bingaman, Johnston, and Wallop and the text of S. 1018 follow:]

PREPARED STATEMENT OF HON. JEFF BINGAMAN, U.S. SENATOR FROM NEW MEXICO

Today the Energy and Natural Resources Committee will hear testimony on S. 1018, the Energy Goals Act of 1991. I thank the Chairman for holding this hearing on legislation which I believe is critical in the development of a workable national energy policy. Despite the hundreds of energy bills which have been introduced in both Houses of Congress, there has been little discussion of what an energy policy is supposed to do, what all this energy legislation is supposed to accomplish. My bill, the Energy Goals Act of 1991, attempts to answer that question in a concrete fashion. Until we answer that question, until this country has reached a consensus as to what we are about with respect to energy, until we have a framework from which to work, we will not be able to agree on whether we are getting the job done.

Goal setting is a regular tool of policy making. It is the first step for determining appropriate policy measures. For example, the President and the nation's governors have not been afraid to establish concrete, quantitative goals for education. By the year 2000, they want, among other things, to have:

- a high school graduation rate of at least 90 percent;
- U.S. students ranking first in the world in math and science achievement; and
- every American adult to be literate.

These are unambiguous and measurable goals. It is clear what is to be achieved and policy options can be evaluated in terms of their contribution towards those goals. I believe we should require no less for our energy policy.

Unfortunately, when it comes to energy policy, efforts to establish concrete goals for energy policy meet with tremendous opposition and suspicion, particularly by the Administration. When we look at the Administration's National Energy Strategy we find commendable, but vague objectives. The lack of specific goals makes evaluation of energy policy options difficult and the formulation of an effective overall strategy impossible.

The Energy Committee, under the very able leadership of its chairman, has spent the last several months wrestling with complex, sometimes politically divisive, issues involving various aspects of energy policy. Those issues will have to be resolved before we can have a comprehensive and cohesive energy policy. I agree with the logic which requires an omnibus energy bill because effective energy legislation cannot be done piecemeal. While the Committee members agreed on many aspects of the chairman's bill, there are some highly controversial provisions which will generate considerable debate on the Senate floor. I am not certain that the Congress will be able to decide which provisions are essential to our national energy policy—for one simple reason. We have not yet reached a consensus on what this energy legislation should do. We have not yet agreed upon the specific goals of a national energy policy.

Other nations take a very different approach to developing their energy policies. I hope that some of today's witnesses will discuss the role of goals in the context of energy policy in other industrialized nations. I hope they also will comment on specific energy goals in those countries.

I would like to take a moment to point out what the Energy Goals Act is not. It is not a replacement for Title III, Energy Targets, of the Energy Security Act of 1980. That title, I note, would be repealed under section 1204 of the Johnston bill. This is very different. The goals laid out in S. 1018 are intended to be specific enough to define a destination without dictating the path, that is, the specific policy measures by which they would be achieved. S. 1018 attempts to define what we mean by "greater energy security."

The Energy Goals Act is not a global warming bill. The potential environmental consequences of increased carbon dioxide emissions are acknowledged, but the bill contains no specific CO_2 reduction goals. The Senator from Colorado, Mr. Wirth, has seen to it that provisions for the study of the CO_2 issue were included in the Johnston omnibus energy bill. Specific actions with respect to carbon dioxide emissions will be considered at the appropriate time. S. 1018 simply recognizes the "no-regrets" approach—reducing CO_2 emissions to the extent practicable while the scientific question is still under investigation.

The goals in the Energy Goals Act are my interpretation of what experts suggest are necessary and achievable energy goals if we are to improve our nation's energy security. I think we should now turn to our expert witnesses and listen to what they have to say. I hope the witnesses will feel free to comment on each other's testimony.

PREPARED STATEMENT OF HON. J. BENNETT JOHNSTON, U.S. SENATOR FROM LOUISIANA

I am pleased to welcome you to this afternoon's hearing on S. 1018, the "Energy Goals Act of 1991". Senator Bingaman's legislation would set specific national energy objectives for reducing the Nation's imports of oil, increasing energy efficiency, and reducing the carbon intensity of the domestic energy mix through greater use of renewable energy.

In theory, the underlying objectives of S. 1018 are laudable. As we are reminded by the recent crisis in the Middle East and last year's drastic fluctuations in the price of oil, the United States is too dependent on foreign sources for its energy supplies. And as I have stated many times in the past, rather than a one word energy policy: *import,* this Nation must have an energy policy that is *Made in America.*

I share my colleague's opinion that economic and environmental realities make it clear that the United States cannot rely solely on domestic oil production to extract itself from recurring national energy crises. In addition, the significant environmental and economic benefits that stem from cost effective energy efficiency and renewable energy measures cannot be ignored. In fact, the Department of Energy estimates that gains in energy efficiency have enabled the U.S. economy to grow by 46 percent since 1973 while increasing energy requirements by only 7 percent.

Yet, despite my strong support for the principles underlying S. 1018, I am not convinced that it is possible to formulate specific numerical targets for a wide variety of energy production, efficiency, and renewable programs. I am also concerned that specific numerical targets such as those proposed in S. 1018 could constrain the Nation's ability to respond to changes in energy technologies, resource base, and political realities. I would prefer to see the Nation explore energy priorities through a least-cost planning process such as the one developed under title I of S. 1220. This title would require the Secretary to a least-cost energy strategy in each National Energy Policy Plan submitted to Congress.

All of today's witnesses have had extensive experience in the fields of domestic and international energy policy. I urge these witnesses to draw on this experience in providing a frank critique of this bill.

Prepared Statement of Hon. Malcolm Wallop, U.S. Senator From Wyoming

Mr. Chairman, for more than 40 years, the Senate has debated the need for a national fuel policy to meet the needs of the United States in times of peace and war.

Because of the recent Middle-East War, the American people, and indeed the world, are ready for a reexamination of our energy dependence on the Persian Gulf. As reported by the Committee, the National Energy Security Act of 1991, S. 1220, reflects such a review. This legislation takes a broad and balanced approach to energy production and energy efficiency throughout our economy.

Moreover, S. 1220 establishes a dynamic process for periodic Congressional review of our nations progress in the implementation of a national energy strategy that supports sustainable growth in an environmentally responsible manner. This is accomplished through a requirement for the preparation of a biennial national energy plan that includes a least-cost national energy strategy as one option. S. 1220 creates a dynamic process with the flexibility to adjust national energy priorities to reflect changing national and international factors as they arise.

I am concerned that S. 1018 endorses a return to static national energy goals and their achievement through centralized Federal management of energy supplies and consumption. This was the approach taken in the Federal energy policies of the 1970's which were formulated in response to energy shortages. This earlier approach was subsequently discredited because of its failure to recognize the inherent efficiencies of competitive markets. I would hope that we can learn from past mistakes.

The goals in S. 1018 are narrowly focused on energy conservation, renewable energy and carbon reductions. There is no mention of any other forms of energy production, such as natural gas, oil, coal or nuclear energy. By comparison, S. 1220 creates a dynamic process for the consideration of such broad, fundamental national goals as energy security, economic vitality and environmental quality. What if any, energy policies there were in the 1970's and 1980's were flawed because they were not formulated from this perspective.

I, therefore, Mr. Chairman, am interested in having today's witnesses address this concern.

II

102D CONGRESS
1ST SESSION

S. 1018

To establish and measure the Nation's progress toward greater energy security.

IN THE SENATE OF THE UNITED STATES

MAY 9 (legislative day, APRIL 25), 1991

Mr. BINGAMAN introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

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A BILL

To establish and measure the Nation's progress toward greater energy security.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be referred to as the "Energy Goals Act of 1991".

SEC. 2. FINDINGS AND GOALS.

The Congress finds that—

(a) petroleum imports threaten national security, the inefficient use of energy resources increases energy United States vulnerability to shortages and reduces international economic competitiveness, and unchecked anthropogenic carbon release may threaten the global environment;

(b) a comprehensive national energy policy is needed to overcome these threats;

(c) such a comprehensive national energy policy must achieve the following goals:

(1) reduce oil imports;

(2) increase energy conservation and efficiency;

(3) decrease the degree of carbon intensity of the domestic energy mix through a variety of strategies including, but not limited to, greater reliance on hydrogen-rich fuels and renewable energy resources.

(d) the establishment of long-term energy policy objectives is necessary to focus and sustain a national effort toward achieving these goals, and thereby achieving national energy security in an environmentally responsible manner. Therefore, Congress establishes the following national energy policy objectives and requires regular reports to the Congress on the Nation's progress toward achieving such goals.

SEC. 3. ENERGY OBJECTIVES.

In pursuing the above goals, the United States should achieve the following specific national energy objectives:

(a) REDUCED OIL CONSUMPTION.—

(1) Oil consumption should be reduced from the 1990 level of approximately 40 percent of the total United States energy resource consumption to 39, 37, 35, and 33 percent in 1995, 2000, 2005, and 2010, respectively;

(2) Annual net oil imports should not exceed 50 percent of United States oil consumption.

(b) INCREASED ENERGY EFFICIENCY.—The energy efficiency, as distinct from energy intensity, of the Nation's economy should be increased by 2 percent per year over the 1990 levels (or 10, 20, 30, and 40 percent in 1995, 2000, 2005, and 2010, respectively).

(c) INCREASED UTILIZATION OF RENEWABLE ENERGY.—The portion of the energy consumption represented by renewable energy sources should increase from the 1990 level of approximately 8 percent to 9, 10, 12, and 14 percent in 1995, 2000, 2005, and 2010, respectively.

SEC. 4. REPORTS TO THE CONGRESS.

(a) PRELIMINARY REPORT.—The Secretary of Energy (hereinafter the "Secretary") shall, within one year after the date of enactment of this Act, submit a report to the Congress setting forth a plan for the achievement of the objectives set forth under this Act including recommendations regarding any additional statutory or budget authority that may be necessary to achieve such objectives. The Secretary also shall determine appropriate measures of energy efficiency for each of the end use sectors and develop plans for acquiring the necessary data; a description of both shall be included in the report. If the Secretary determines that achievement of the objectives set forth under this Act is not practicable, then the Secretary shall state the reasons for that determination and shall propose alternate energy objectives that are in the Secretary's judgment practicable.

(b) REPORTS.—By July 15 of 1996, 2001, 2006, and 2011, the Secretary shall submit to the Congress a report detailing the Nation's progress as of December 31 of the previous year in achieving the objectives set forth in section 3. In all but the final report, the Secretary also shall make recommendations regarding changes in statutory or budget authority as may be necessary in the Secretary's judgment for the timely achievement of the energy objectives set forth in section 3.

Senator **Bingaman**. Let me now turn to the witnesses. We have a distinguished group of witnesses today. Our first is Mr. Peter Saba, who is the Principal Associate Deputy Under Secretary for Policy, Planning and Analysis with the Department of Energy.

Thank you for being here, Mr. Saba.

Mr. **Saba**. Thank you. I appreciate the opportunity to appear here before the Committee today and present the administration's views on S. 1018, the Energy Goals Act of 1991. I would like to submit my written testimony for the record and summarize the main points.

Senator **Bingaman**. We will include each of the witness' testimony in the record. So go ahead.

STATEMENT OF PETER B. SABA, PRINCIPAL ASSOCIATE DEPUTY UNDER SECRETARY FOR POLICY, PLANNING AND ANALYSIS, DEPARTMENT OF ENERGY

Mr. **Saba**. S. 1018 proposes very specific goals to reduce our dependence on oil imports, to increase energy conservation and efficiency, and to decrease the carbon intensity of our domestic energy mix. While these general goals may be laudable, the mandatory targets it establishes are not.

We very much support keeping score or measuring our progress toward appropriate national energy, economic, and environmental goals. That is why we developed the National Energy Strategy. We fully intend to grade ourselves and others on how well we are doing in implementing the measures set forth there.

However, as we stated in the National Energy Strategy (NES) released last February, this administration believes the keystone of any successful energy strategy must be reliance on free and competitive markets. The Federal Government has an important role in removing or overcoming barriers to efficient market operation so that market signals can reach all energy producers and consumers in a clear, consistent and realistic way. Their responses to those market signals should, however, remain a matter of private decision-making and not a matter of Government-imposed targets.

The NES process was built by setting broad goals and developing a strategy to help achieve those goals. These broad goals consisted of achieving greater energy security, improving energy and economic efficiency, enhancing environmental quality, and fortifying our foundations.

The NES did not set targets or establish a plan to achieve certain levels of fuel use. Rather, built from the ground up with significant public input, the NES identified Federal, State, local government and private actions that would expand the fuel and technology choices available to the private sector.

We then projected the impact of these actions on future energy supply and demand, the economy, and the environment. Whether these projections turn out to be achieved in fact will depend on a number of variables, including the countless decisions of individual domestic and international energy producers and consumers, passage of statutory changes proposed in the NES, successful implementation of the NES administrative action items, and the impact of research and development.

Unlike this ground-up approach, S. 1018 takes a top-down approach of setting specific targets, called "objectives" in the bill, and requiring the development of a plan to achieve those targets.

Such a top-down approach in the enormously complex and interwoven energy area is flawed for a number of reasons. First, such targets are arbitrary and do not reflect the full range of objectives that a balanced energy strategy should address. Why is 35 percent of oil consumption in 2005 the right level? Is 50.1 percent net oil imports the proper measure of unacceptable oil vulnerability? Is it significantly different than 49 percent? What is the justification for 14 percent renewable energy sources in the year 2010, regardless of cost or other clean alternatives?

Second, experience demonstrates that targets and plans set by the central government do not work and will do more economic and will do more economic and other harm than good.

Third, energy targets as proposed in S. 1018 lack flexibility and have limited relevance in an international energy market. In a market economy, countless individual decisions by producers and consumers determine the level of energy goods and services that are provided. The flexibility of this system and the ability of consumers and producers to adjust to price signals is at the core of our dynamic economy.

Moreover, these countless decisions are made domestically and abroad. In an international energy market comprised of innumerable economic actors, U.S. Federal Government targets alone have limited relevance.

Finally, specific targets are not necessary in order to achieve substantial progress toward a cleaner and more secure energy future. As described more fully in my written testimony, this Nation already has made major advances toward meeting the goals of S. 1018, without the requirement of specific Federal targets.

Furthermore, a preliminary analysis of S. 1018 comparing the National Energy Strategy and this committee's recently passed S. 1220, the National Energy Security Act of 1991, shows that the Nation would make substantial progress toward meeting the goals of S. 1018, without imposing some of the Draconian measures that would be necessary to achieve the specific targets in the bill.

A few examples will illustrate the progress we have made to date. Under the targets set in S. 1018, energy efficiency is to be increased by 2 percent per year over 1990 levels, for a total of 40 percent by 2010.

American producers and consumers have been and are currently including cost-effective energy efficiency in their decision-making process. As a result, energy efficiency has improved in all sectors of the economy. Between 1978 and 1987, on-site residential energy use per household dropped by more than 25 percent, an average of 2.5 percent a year.

In the commercial sector, energy use per square foot of commercial floor space dropped more than 25 percent from 1979 to 1986, an average improvement of 3 percent per year. This improvement is especially encouraging in light of the growing amount of computer equipment which has become a major source of growth and electricity demand.

Industrial energy use per unit of output has also dropped by over 3 percent per year, for a total of 43 percent from 1975 to 1988.

All of these improvements compare favorably with the overall efficiency target of 2 percent improvement a year in S. 1018.

S. 1018 also would set targets for renewable energy production as a percentage of consumption. Renewable energy sources provided only 4.7 quads of the primary energy consumed in 1975. That was 6.7 percent. By 1990, the percentage contributed by renewables had increased by 22 percent to 8.2 percent of the total. And we expect the use of renewables to continue to grow.

In 1975, essentially all of the renewable energy came from hydropower and wood burning. Now the energy provided by renewable sources includes increasing contributions from geothermal powerplants, municipal waste-to-energy plants, wind farms, solar energy systems, and alcohol fuel plants.

Cost reductions and performance improvements have made these technologies more attractive in the marketplace. As environmental and regulatory barriers to the more mature renewable technologies are removed, and as emerging renewable technologies become mature, renewables should penetrate the Nation's energy markets more broadly.

Furthermore, using the market to promote growth in the use of renewable resources will avoid the unrealistic expectations and consequent setbacks of some earlier renewable programs.

In preparation for this hearing, the Department performed a preliminary analysis of S. 1018, as well as mechanisms that might be necessary to achieve the specific targets in the bill. This analysis is summarized in the table attached to my testimony. The actions comprising both the National Energy Strategy scenario and this committee's S. 1220 are projected to come close to achieving the targets of S. 1018.

In fact, after 1995, both the NES and S. 1220 are projected to be at or below the 50 percent oil import level. However, the analysis also indicates that costly, inflexible and potentially crippling measures would be required to achieve all of the specific targets fully.

For comparison purposes, DOE ran a set of energy production and consumption simulations consistent with the provisions of S. 1220. The results of the S. 1220 simulations did not meet the full set of targets in S. 1018 in all target years. However, S. 1220 can exceed the oil consumption target in 1995, but reach 36 percent of energy resource consumption rather than 33 percent in 2010; reach 98 percent of the efficiency target in 1995, decreasing to 82 percent by 2010, and reach over 93 percent of the renewable target in 1995, but achieving 10 percent utilization of renewable energy in 2010 as compared to the 14 percent target.

DOE performed a second set of simulations that includes an additional renewable option—municipal solid waste-to-energy—and imposed a $35 per ton carbon tax from 1992 through 1995 and $135 per ton thereafter.

This simulation achieved the efficiency and oil consumption targets in 1995 and the import targets, but failed to achieve the other targets. Even increasing the carbon tax to a crippling $250 per ton did not permit all of the targets of S. 1018 to be met simultaneously in 2010.

In a third simulation, the supply-side options of increased access to the Arctic National Wildlife Refuge, nuclear research and development, natural gas regulatory reform, and advanced oil recovery were eliminated. The carbon tax was maintained.

This simulation resulted in higher energy prices and reduced supply which reduced overall energy consumption. Despite these higher costs, however, there was very little difference between this and the carbon tax simulation described above in terms of meeting the energy targets.

In other words, imposition of a carbon tax and rejection of options to remove barriers to fossil and nuclear production, as some have called for, would not achieve the targets set forth in this bill.

This preliminary analysis indicates that it will be difficult to reach the targets set out in S. 1018. We believe that some seemingly Draconian measures would be necessary to achieve all the levels set in the bill. A $1 a gallon gasoline tax on top of the $250 carbon tax would be needed to achieve the last 2 percent of the consumption target.

But our analysis indicates that the S. 1018 targets still would not all be met in 2010. However, it's equally important to recognize that S. 1220 reaches sufficiently close to the goals of S. 1018 without posing undue burdens on the economy.

Finally, current statutory requirements for energy targets and reports provide valuable experience as to the potential utility of S. 1018. DOE has had the responsibility for Title III, energy targets, which requires that the President submit to Congress energy targets for net imports, domestic production, and end-use consumption of energy for certain calendar years in a prescribed format in February of every odd-numbered year.

These energy targets, however, are not actually targets as offered by S. 1018 but rather are projections based on current energy production and consumption patterns. These projections have presented only one possible energy future, with many others also being likely depending on the outcome of a myriad of highly unpredictable future events.

Thus, the energy targets presented in the past were not what the Federal Government believes energy markets should do, but our best guess as to what they would do. Government energy forecasts cannot reflect all the information that private consumers, workers, managers, inventors, and investors will have and use in shaping our energy future.

No one, including DOE forecasters, has the ability to anticipate unexpected events and technological changes that will influence the composition of future energy supply and demand. These have made past Government energy projections inaccurate and of limited utility.

It is not this administration's policy to set fuel-specific energy production and consumption targets. We are therefore pleased that S. 1220 repeals Title III of the Energy Security Act.

In conclusion, we believe that wherever possible, markets should be allowed to determine prices, quantities, and technology choices. Targets are blunt and imprecise tools that will impose unforeseen costs by reducing the flexibility of the economy.

As the rest of the world follows in the path of the great American economic achievement based on market reliance, now is not the time for us to take a step backward, but forward with S. 1220 and the National Energy Strategy.

This concludes my prepared statement. I would be happy to answer any questions you might have.

[The prepared statement of Mr. Saba follows.]

PREPARED STATEMENT OF PETER B. SABA, PRINCIPAL ASSOCIATE DEPUTY UNDER SECRETARY FOR POLICY, PLANNING AND ANALYSIS, DEPARTMENT OF ENERGY

OVERVIEW

I appreciate the opportunity to appear before the Committee today and present the Administration's views on S. 1018, the "Energy Goals Act of 1991". This bill proposes very specific goals to reduce our dependence on oil imports, to increase energy conservation and efficiency, and to decrease the carbon-intensity of our domestic energy mix. While these general goals may be laudable, the mandatory targets it establishes are not.

As we stated in the National Energy Strategy (NES) released last February, this Administration believes that the keystone of any successful energy strategy must be a reliance on free and competitive markets. The Federal government has an important role in removing or overcoming barriers to efficient market operation so that market signals can reach all energy producers and consumers in a clear, consistent, and realistic way. Their responses to those market signals should remain a matter of private decision making, and not a matter of government imposed targets.

The NES process was built upon the successful policy of market reliance by setting broad goals and developing a strategy to help achieve those goals. These broad goals consisted of achieving greater energy security, improving energy and economic efficiency, enhancing environmental quality and fortifying our foundations. The NES did not set targets or establish a plan to achieve certain levels of fuel use. Rather, built from the ground up with significant public input, the NES identified Federal, State, local government and private actions that would expand the fuel and technology choices available to the private sector. We then projected the impact of these actions on future energy supply and demand, the economy and the environment. Whether these projections turn out to be achieved in fact will depend on a number of variables including the countless decisions of individual domestic and international energy producers and consumers, passage of statutory changes proposed in the NES, successful implementation of the NES administrative action items and the impact of research and development.

Unlike this ground up approach, S. 1018 takes a top down approach of setting specific targets (called "objectives" in S. 1018) and requiring the development of a plan to achieve those targets. Such a top down approach in the enormously complex and interwoven energy area is flawed for a number of reasons. First, such targets are arbitrary and do not reflect the full range of objectives that a balanced energy strategy should address. Why is 35% oil consumption in 2005 the "right" level? Is 50.1% net oil imports the proper measure of unacceptable oil vulnerability? Is it significantly different than 49%? What is the justification for 14% renewable energy sources in the year 2010, regardless of cost or other clean alternatives?

Second, experience demonstrates that targets and plans set by the central government do not work and will do more economic and other harm than good. We have seen the failed experiences of the U.S.S.R. and other centrally-planned economies, with their well documented narrow ranges of consumer and producer choices, and we have seen them make the move to more market-based economies. As these countries move away from the failure of central planning, do we now want the Federal government to set targets and develop plans to achieve those targets in the energy sector? We think not. And even if we did, what radical transformation of our society and government would be necessary to achieve those ends? The process of effectively achieving arbitrarily set energy targets requires a level of command and control not compatible with the U.S. market-based economy, or with the freedom of choice enjoyed and expected by the citizens of this Nation.

Energy targets as proposed in S. 1018 lack flexibility and have limited relevance in an international energy market. As noted earlier, in a market economy countless individual decisions by producers and consumers determine the level of energy goods and services that are provided. The flexibility of this system and the ability of consumers and producers to adjust to price signals is at the core of our dynamic economy. Imposition of Federal government targets would effectively usurp the decisions of individual consumers and producers. Moreover, these countless decisions are made domestically and abroad. In an international energy market comprised of innumerable economic actors, U.S. Federal government targets alone have limited relevance.

Finally, specific targets are not necessary in order to achieve substantial progress toward a cleaner and more secure energy future. As described below, this Nation already has made major advances toward meeting the goals of S. 1018, without the requirement of specific Federal targets. Furthermore, a preliminary analysis by the Department of Energy (DOE) of S. 1018, comparing the National Energy Strategy and this Committee's recently passed S. 1220, the National Energy Security Act of 1991, shows that the Nation would make substantial progress toward meeting the goals of S. 1018, without imposing the draconian measures that would be necessary to achieve the specific targets in the bill.

PROGRESS TO DATE

Oil consumption, under the targets set in S. 1018, estimated to be 40 percent of total U.S. energy consumption in 1990,[1] is to be reduced to 39 percent in 1995, 37 percent in 2000, 35 percent in 2005, and 33 percent in 2010.

In our current energy system, the mix of energy forms is determined by the individual decisions of energy producers and consumers as they respond to price signals in the marketplace. To accomplish the goals set forth in this bill requires either mandating choices for certain consumers and/or producers, or changing the price signals in the marketplace through energy taxes and subsidies. We believe neither is acceptable.

Oil remains our central transportation fuel. The fuel economy of light-duty vehicles (automobiles and light trucks) has improved significantly over the past 15 years. For example, new car fuel economy has more than doubled since 1973. In addition, electric utilities have also shifted away from oil, with oil now accounting for only four percent of electric generation. The bulk of these changes to reduce oil use happened in response to market signals, namely the higher oil prices that occurred in 1973 and 1979, and not due to government intervention in the marketplace.

We agree that dependence on oil, regardless of its source, must diminish whenever and wherever it is cost effective to do so. Even if we were self-sufficient in oil, arise in the world oil price would affect our economy adversely. This was Great Britain's experience in 1979, in marked contrast to that of Japan which did (and still does) import all the oil it uses. Since two-thirds of our oil is used in the transportation sector, we believe we can reduce our economy's vulnerability to changes in world oil prices by making alternative fuel vehicles and vehicles with alternative propulsion systems available and attractive to the public. The NES offers the public choices, choices in fuels and choices in vehicles, not mandates on how much oil it can consume.

Energy efficiency, under the targets set in S. 1018, as measured by the ratio of primary energy consumption to the real gross national product, is to be increased by 2 percent per year over 1990 levels, for a total of 40 percent by 2010.

American producers and consumers have been and are currently including cost-effective energy efficiency in their decision-making processes. As a result, energy efficiency has improved in all sectors of the economy. Between 1978 and 1987, on-site residential energy use per household has dropped by more than 25 percent, an average of 2½ percent per year.[2] This improvement is the result of a number of factors, including the improved efficiency of new homes and appliances, homeowner investments in energy-saving measures for existing housing such as better insulation, the population shift to warmer climates, and behavioral changes in response to higher energy prices.

In the commercial sector, energy use per square foot of commercial floor space dropped by more than 25 percent from 1919 to 1986, an average improvement of 3% per year. This improvement is especially encouraging in light of the growing amount of computer equipment which has become a major source of growth in electricity demand.

Industrial energy use per unit of output has also dropped by over 3 percent per year, for a total of 43 percent from 1975 to 1988. About half of this change in energy intensity was due to efficiency improvements made by industry in response to energy prices. The other half was due to structural shifts in U.S. demand—away from the products of energy-intensive industries, and away from producing energy-intensive goods (such as steel production) domestically to importing them.

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[1] According to the Energy Information Agency's June 1991 *Monthly Energy Review*, petroleum represented about 41% of 1990 total U.S. energy consumption.

[2] Energy efficiency data cited in this section is based on the most recent survey data available for each sector.

Renewable energy sources, under the targets set in S. 1018, as a portion of energy consumption, is to be increased from the 1990 level of 8 percent to 9 percent in 1995, 10 percent in 2000, 12 percent in 2005, and 14 percent in 2010.

Renewable energy sources provided only 4.7 quads of the primary energy consumption total of 70.5 quads in 1975, or 6.7 percent. By 1990, the percentage contribution of renewables had increased by 22 percent to 6.7 quads of the 81.4 quads of primary energy consumed, or 8.2 percent of the total. And we expect the use of renewables to continue to grow. In 1975 essentially all of the renewable energy came from hydropower and wood burning. Now the energy provided by renewable sources includes increasing contributions from geothermal powerplants, municipal waste-to-energy plants, wind farms, solar energy systems, and alcohol fuel plants.

Cost reductions and performance improvements have made these technologies more attractive in the marketplace. As environmental and regulatory barriers to the more mature renewable technologies are removed, and as emerging renewable technologies become mature, renewables should penetrate the Nation's energy markets more broadly. Furthermore, using the market to promote growth in the use of renewable energy resources will avoid the unrealistic expectations and consequent setbacks of some earlier renewables programs.

ANALYSIS OF S. 1018

The Department of Energy performed preliminary analysis of S. 1018 as well as mechanisms that might be necessary to achieve the specific targets of S. 1018. This analysis is summarized in the attached table. The actions comprising both the National Energy Strategy Scenario and this Committee's recently passed S. 1220, the National Energy Security Act of 1991, are projected to come close to achieving the targets of S. 1018. In fact, after 1995, both the NES and S. 1220 are projected to be at or below the 50 percent oil import level. However, the analysis also indicates that costly, inflexible and potentially crippling measures would be required to achieve all of the specific targets fully.

S. 1220

For comparison purposes, DOE ran a set of energy production and consumption simulations consistent with the provisions of S. 1220. The provisions of S. 1220 included in the simulation were:

- the current policy base case of the NES;
- hydroelectric regulatory reform;
- building standards;
- industrial research and development;
- integrated resource planning;
- access to the Alaskan National Wildlife Refuge;
- advanced nuclear reactor commercialization;
- nuclear reactor licensing reform;
- natural gas regulatory reform;
- transportation research and development;
- oil shale research and development;
- renewables technologies research and development;
- advanced oil recovery research and development; and
- clean coal market incentives.

The results of the S. 1220 simulation did not meet the full set of targets in S. 1018 in all target years. However, S. 1220 can:

- exceed the oil consumption target in 1995, but reach 36 percent of energy resource consumption rather than 33 percent in 2010;
- reach 98 percent of the efficiency target in 1995, decreasing to 82 percent by 2010; and
- reach over 93 percent of the renewable target in 1995, but achieving 10% utilization of renewable energy in 2010 as compared to the 14% target (this is equal to generating 11 quads rather than 12.7 quads needed to meet the target under the S. 1018 target case in 2010).

S. 1220 WITH A CARBON TAX

DOE performed a second set of simulations that included an additional renewable option (municipal solid waste-to-energy) and imposed a $35 per ton carbon tax from 1992 through 1995 and $135 per ton thereafter. In order to calculate compliance with the efficiency target, it is necessary to make the unrealistic assumption that these carbon taxes would have no impact on GNP levels. Since it is possible that over the next 18 years the carbon taxes described above could have at least a $750 billion cumulative impact on the economy, i.e, reduce the GNP by more than 1.4 percent, the likelihood of reaching the target levels of energy efficiency are reduced further as fewer energy efficiency investments would be made.

This simulation achieved the efficiency and oil consumption targets in 1995. In 2010, however, oil consumption is projected to be 36.6 percent rather than the 33 percent for the oil target set forth in S. 1018. Eighty-five percent of the efficiency target is estimated to be reached in 2010. Ninety-six percent of the renewable target would be met by 1995. The same number of quads would be generated in 2010 as required to meet the target under the S. 1018 target case because the relative price of renewables decreases, but this would represent 12% of 2010 consumption in this scenario rather than the 14% target. Even increasing the carbon tax to a crippling $250 per ton did not permit all of the targets of S. 1018 to be met simultaneously in 2010.

S. 1220 WITHOUT SUPPLY-SIDE OPTIONS

In a third simulation, the supply-side options of increased access to the Alaskan National Wildlife Refuge, nuclear research and development, natural gas regulatory reform, and advanced oil recovery were eliminated. The carbon tax was maintained. This simulation resulted in higher energy prices and reduced supply which reduced overall energy consumption. Despite these higher costs, however, there was very little difference between this and the carbon tax simulation described above in terms of meeting the energy targets. In other words, imposition of a carbon tax and rejection of options to remove barriers to fossil and nuclear production, as some have called for, would not achieve the arbitrary targets set forth in this bill. This simulation achieved the efficiency and oil consumption targets in 1995. Achievement of the efficiency target decreased to 86 percent in 2010. Oil consumption was 36.9 percent rather than the 33 percent target in 2010, and again was higher than that projected for S. 1220. Ninety-six percent of the renewable target would be met by 1995. While 13.1 quads from renewables would be generated in 2010, more than the 12.7 quads under the S. 1018 target case, this would still represent 12.4% of 2010 consumption in this scenario rather than the 14% target. In this simulation only, the proportion of oil imported exceeds the 50 percent target both in and after 1995, growing to two-thirds by the year 2010.

This preliminary analysis indicates that it will be difficult to reach the targets set out in S. 1018. We believe that some seemingly draconian measures would be necessary to achieve all the arbitrary levels set in S. 1018. A $1 a gallon gasoline tax on top of the $250 carbon tax would be needed to achieve the last 2 percent of the consumption target, but our analysis indicates the S. 1018 targets still would not all be met in 2010. However, it is equally important to recognize that S. 1220 reaches sufficiently close to the goals of S. 1018 without imposing undue burdens on the economy.

ENERGY TARGETS AND REPORTS

Finally, current statutory requirements for energy targets and reports provide valuable experience as to the potential utility of S. 1018. DOE has had the responsibility for Title III, Energy Targets, of the Energy Security Act which requires that the President submit to Congress ". . . energy targets for net imports, domestic production, and end-use consumption of energy for the calendar year 1985, 1990, 1995, and 2000" in a prescribed format in February of every odd-numbered year.

These energy targets, however, are not actually targets as offered by S. 1018 but rather are projections based on current energy production and consumption patterns. The energy targets projections submitted in compliance with Title III have represented only one possible energy future, with many others also being likely depending on the outcomes of a myriad of highly unpredictable future events. Numerous private decisions over the course of years will determine the exact amounts and types of energy produced and consumed in the future.

Thus, the energy targets presented in the past were NOT what the Federal government believes energy markets should do, but our best guess as to what they would do. Government energy forecasts cannot reflect all the information that private consumers, workers, managers, inventors, and investors will have and use in shaping our energy future. No one (including DOE forecasters) has the ability to anticipate unexpected events and technological changes that will influence the composition of future energy supply and demand. These have made past government energy projections inaccurate and of limited utility.

It is not this Administration's policy to set fuel-specific energy production and consumption targets. A keystone of our National Energy Strategy is continuing the successful policy of market reliance. We are therefore pleased that Section 1204 of Title I of the National Energy Security Act of 1991, S. 1220, overwhelmingly passed by this Committee, repeals Title III of the Energy Security Act.

CONCLUSION

In conclusion, we believe that wherever possible, markets should be allowed to determine prices, quantities, and technology choices. Targets are blunt and imprecise tools that will impose unforeseen costs by reducing the flexibility of the economy. As the rest of the world follows in the path of the great American economic achievement based on market reliance, now is not the time for us to take a step backward, but forward with S. 1220 and the National Energy Strategy.

This concludes my prepared statement and I would be happy to answer any questions you might have.

Simulations for Analysis of S. 1018

	S. 1018 Target				NES				Sim. 1*			
Efficiency	1995	2000	2005	2010	1995	2000	2005	2010	1995	2000	2005	2010
energy use	90.1	92.5	93.1	90.5	91.8	99.3	105.3	110.8	91.8	99.2	105.5	111.2
real GNP	6474	7472	8600	9756	6474	7472	8600	9756	6474	7472	8600	9756
efficiency	0.0139	0.0124	0.0108	0.0093	0.0142	0.0133	0.0122	0.0114	0.0142	0.0133	0.0123	0.0114
Renewables	1995	2000	2005	2010	1995	2000	2005	2010	1995	2000	2005	2010
renewable quads	8.1	9.2	11.2	12.7	7.8	9.0	10.3	11.8	7.7	8.5	10.0	11.0
total energy use	90.1	92.5	93.1	90.5	91.8	99.3	105.3	110.8	91.8	99.2	105.5	111.2
renewable %	0.090	0.100	0.120	0.140	0.085	0.091	0.098	0.106	0.084	0.086	0.095	0.099
Oil	1995	2000	2005	2010	1995	2000	2005	2010	1995	2000	2005	2010
total oil quads	35.1	34.2	32.6	29.9	34.7	35.9	37.3	38.0	34.8	36.4	38.8	40.3
imported oil quads	17.6	17.1	16.3	14.9	18.9	17.6	15.4	16.6	19.0	18.1	16.8	19.0
total energy use	90.1	92.5	93.1	90.5	91.8	99.3	105.3	110.8	91.8	99.2	105.5	111.2
oil % of total energy	0.390	0.370	0.350	0.330	0.378	0.362	0.354	0.343	0.379	0.367	0.368	0.362
import % of oil	0.50	0.50	0.50	0.50	0.54	0.49	0.41	0.44	0.55	0.50	0.43	0.47

*Simulation 1 -- Current Policy Base Case plus provisions of S. 1220

Simulations for Analysis of S. 1018

	S. 1018 Target				Sim. 2*				Sim. 3**			
Efficiency	1995	2000	2005	2010	1995	2000	2005	2010	1995	2000	2005	2010
energy use	90.1	92.5	93.1	90.5	90.3	92.6	99.9	106.8	90.1	92.2	98.9	105.6
real GNP	6474	7472	8600	9756	6474	7472	8600	9756	6474	7472	8600	9756
efficiency	0.0139	0.0124	0.0108	0.0093	0.0139	0.0124	0.0116	0.0109	0.0139	0.0123	0.0115	0.0108
Renewables	1995	2000	2005	2010	1995	2000	2005	2010	1995	2000	2005	2010
renewable quads	8.1	9.2	11.2	12.7	7.8	9.0	10.2	12.7	7.8	9.0	10.2	13.1
total energy use	90.1	92.5	93.1	90.5	90.3	92.6	99.9	106.8	90.1	92.2	98.9	105.6
renewable %	0.090	0.100	0.120	0.140	0.086	0.097	0.102	0.119	0.087	0.098	0.103	0.124
Oil	1995	2000	2005	2010	1995	2000	2005	2010	1995	2000	2005	2010
total oil quads	35.1	34.2	32.6	29.9	34.4	34.8	37.5	39.1	34.9	35.7	37.7	39.0
imported oil quads	17.6	17.1	16.3	14.9	18.6	16.7	15.8	17.8	19.5	21.0	24.0	26.2
total energy use	90.1	92.5	93.1	90.5	90.3	92.6	99.9	106.8	90.1	92.2	98.9	105.6
oil % of total energy	0.390	0.370	0.350	0.330	0.381	0.376	0.375	0.366	0.387	0.387	0.381	0.369
import % of oil	0.50	0.50	0.50	0.50	0.54	0.48	0.42	0.46	0.56	0.59	0.64	0.67

*Simulation 2 -- Sim. 1 with carbon tax and additional renewable option, and without oil shale R&D

**Simulation 3 -- Sim. 2 without ANWR, nuclear R&D, natural gas regulatory reform, & advanced oil recovery

Senator BINGAMAN. Thank you very much. Let me see if I understand your position. Your view is you disagree with the particular goals that we have in this bill. Is that correct?

Mr. SABA. That is correct. And I think it goes broader than that. It will be very difficult to determine specific goals that encompass both all the broad general goals that the NES and S. 1220 are directed at, and the decisions that actually result in the outcomes.

Senator BINGAMAN. Well, I guess I understand that it is hard to set goals that encompass the whole enchilada. But the question that I have is on an issue like the percentage of the oil we consume that we want to have to import. Is it your position that it is improper for the Government to have a goal in that regard?

Mr. SABA. I am not sure that we would go so far as to say that a general goal, either of reducing imports or keeping them below a certain level, is improper per se. But even in this instance as a measure of our vulnerability to oil price shocks, it is a very blunt instrument to say that below 50 percent we are more energy secure.

The experiences of Japan and Great Britain after the 1979 price shock is a good example of how imports per se don't necessarily matter.

Senator BINGAMAN. You are saying that there are no indicators in this energy area that we need to look at to see whether we are better off or worse off?

Mr. SABA. Oil import levels is one indicator that determines our energy vulnerability. Oil consumption is a second one. And both of those are included.

But there are many others as far as our flexibility to do fuel-switching, our actual ability in industry as far as their dependence within different sectors on oil, the availability of alternative fuels, and the like.

Senator BINGAMAN. I guess my concern is why is it that the administration believes it is appropriate to have goals in education and identify six indicators to determine whether we are doing what we need to as a Nation in education but it is not appropriate to have goals in energy?

Mr. SABA. First of all, the education goals were combined Federal-State. The President went and met with the Governors.

Senator BINGAMAN. Well, we can invite the Governors to participate in the setting of energy goals, too. I would support that.

Mr. SABA. I do not think that we are adverse to sitting down and discussing whether we can achieve some sort of set of goals that one can measure progress against. And that is basically what they did in the education area.

The other thing about education is that it is very different than the energy sector. Education is inherently a Government activity. People are educated for the most part in the public sector, and as I say, that is very different from the market-based and international system that we deal with when we talk about the energy sector.

Senator BINGAMAN. I guess I still don't understand why setting goals is an appropriate thing to do, even in areas where the Government doesn't control all the factors. I mean, it is clear in energy that most of what happens in energy is determined by the private sector—appropriately so. It doesn't mean that Government shouldn't have a set of conditions that it is trying to achieve.

Mr. SABA. We don't oppose goals per se. And in the National Energy Strategy, as I said, we had broad goals and some of those are stated in S. 1220 as well. We are concerned about setting specific targets, especially for particular fuel types.

Senator BINGAMAN. If you do not object to goals as a general matter, what is objectionable about getting specific? I am not advocating here that we put a dollar tax on gasoline or anything. For example, on S. 1220, have you done a simulation to determine where we are going to be in the year 2000, assuming that we pass this bill and the President signs it into law?

Mr. SABA. Yes, we have run those simulations.

Senator BINGAMAN. What percent of our oil will be imported, in your opinion? Or maybe, how many million barrels per day will be imported in your opinion, by the year 2000? Do you have a figure?

Mr. SABA. Oil imports in the year 2000, under S. 1220, I believe are projected to be at about 50 percent, with oil imports in million barrels per day being 8.4 million barrels per day. We would like to note that this is a decrease of almost 3 million barrels per day from the current policy projections.

Senator BINGAMAN. So you are saying we will be importing 8.4 million barrels per day by the year 2000 after we adopt S. 1220?

Mr. SABA. Right. And without S. 1220, it would be about 11.3 million.

Senator BINGAMAN. Have you had a chance to look at the testimony that Mr. Blair is providing today and the charts that the Office of Technology Assessment has prepared?

Mr. SABA. We have not seen that testimony or the charts yet.

Senator BINGAMAN. It was testified to here last fall. We have had two or three hearings on it. Maybe someone could hand Mr. Saba a copy of that testimony and you could look at figures 1 and 2 attached to it.

Do you have that in front of you?

Mr. SABA. Yes, I do now.

Senator BINGAMAN. I guess my real question is, do you know if the administration agrees with those projections?

The OTA projection is that we will increase our imports quite substantially between now and the year 2000, and again quite substantially between the year 2000 and the year 2020, as I understand these charts.

Mr. SABA. In the current policy case, without changes, even Current Policy Base case in the National Energy Strategy projects that there will be a significant increase in imports.

Senator BINGAMAN. Then you take figure 2 down toward the bottom of that same page and it shows how they anticipate imports would go if we do some of these other things that have been suggested.

But I would suggest to you that most of the reduction that they identify or potential reduction in imports would come from increased CAFE standards, which the administration opposes, as I understand it.

I am just wondering if you agree with that bottom chart as well?

Mr. **Saba**. We have not run the specific numbers as to where their projections on CAFE or these particular miles per gallon will get you as far as oil import savings.

We have done analysis within the Department on how we can reduce oil consumption in the transportation sector. And the position that we have taken is that alternative fuels and alternative technologies which get us off our total dependence on oil in the transportation sector are a far better way to reduce our oil vulnerability than imposing higher CAFE standards.

Senator **Bingaman**. Do you have those quantified so that you could tell me how much you expect to reduce imports, net imports, from these shifts to alternative fuels under S. 1220?

Mr. **Saba**. I have under the National Energy Strategy the assumptions as far as the estimates for reduction due to alternative fuels and technologies.

It is based on how much we reduce our oil, how much oil we would save through these measures, if you assume that the last barrel of oil saved is a reduction in imports. That would translate into reduction of imports.

We estimate that through the use of alternative fuels in the year 2010, we would save about 2.2 million barrels per day, with additional R&D and efficiency gains through alternative technologies of 1.2 million barrels per day. So that is a total of 3.4 million per barrels per day reduction in the year 2010.

Senator **Bingaman**. I guess my question would be, if the administration does not object to goals, could you get back to me and tell me what goals you think are appropriate for us to include in S. 1018 in order to accurately reflect where you expect us to be going over the next 15 years or 20 years?

Mr. **Saba**. I raise the question there that if the targets or goals that we are going to set are basically only those that we project, either under the Current Policy Base case or under the measures we have deemed acceptable, I am not sure what the value added is of setting those targets.

We have already told you our projections. And we are happy to measure our progress in those areas against those projections. We plan to prepare a National Energy Strategy every 2 years and report that progress. I am sure that we will be up here testifying on an annual basis on how we have done in implementing the National Energy Strategy.

So if the targets we are setting are only those that we have already projected, we have those projections.

Senator **Bingaman**. I just had not seen those projections before this afternoon. Maybe those are widely distributed and the public out there understands exactly where we are trying to get and what the expectation is as to what will happen over the next 15 years or 20 years?

I was not aware that you had come down with specific, concrete estimates as to where this is going to get us. And your testimony is that you have and that you will stand behind those. And evidently, you have those available for us here in your testimony.

Mr. **Saba**. But I do have to caveat that projections are and they have proven to be, projections by the Department of Energy, projections by OTA, or any other modelers, are inherently unreliable.

Senator BINGAMAN. I understand that. None of us can give a guarantee as to what is going to happen in the future.

But the idea is, if we adopt a particular bill which the administration supports, at least to the extent possible we should have a consensus between the administration and the Congress as to what we are trying to accomplish with that bill.

And you do not object to that, as I understand it?

Mr. SABA. No. And we have said on the oil import issue as far as oil import levels, the NES is projected to keep oil imports at the 40 percent to 45 percent level. And that in the year 2010, imports are going to be reduced by about 7 million barrels per day as I indicated.

Senator BINGAMAN. To about 7 million barrels per day.

Mr. SABA. No, by about 7 million from projected levels. And that is, as I indicated, about 3.4 million barrels a day from the conservation or fuel switching in the transportation area and about 3.8 million through increased domestic production.

Senator BINGAMAN. I will, of course, ask Mr. Blair on this, but from the figures that I am hearing from you there is a major, major disagreement as between you and the Office of Technology Assessment as to the extent to which we are going to have to be importing oil by the year 2010.

Your projection is that we will be importing less than 8 million barrels per day. As I read just an estimate here, just sort of eyeballing it, it looks to me like OTA estimates clearly 50 percent more than that or maybe substantially more than 50 percent.

Mr. SABA. The OTA estimate on figure 2 is in the Current Policy Base case. And just eye-balling it, in the year 2010 it looks like oil imports are roughly about where we are projecting in the current policy base case.

The under 8 million barrels per day is a result of this 7 million barrels per day savings or reduction in oil imports that we project the NES will produce.

Senator BINGAMAN. I would just ask, rather than taking more time to go through the specifics or trying to read these charts, maybe you could get us some information as to what your projections are as to what we will accomplish through S. 1220 in each of these years and we will get OTA to try to do the same kind of thing. And let us see if we have a consensus. It would be great if we did.

That would allow us to say, okay, this is what we think we are about here. Does that seem like a reasonable course?

Mr. SABA. Yes. We would be happy to do that. We have provided to the Congress our technical annex 2 that contains all of our projections and data results. But we can summarize those and submit them for the record.

[The information referred to follows:]

A summary of the results of the integrated analysis of the combined NES actions follows. The summary is taken from Technical Annex 2, Integrated Analysis Supporting the National Energy Strategy: Methodology, Assumptions, and Results. The Department is responding to Senator Bingaman's question on analysis of S. 1220 separately.

3. Integrated Analysis of National Energy Strategy Actions

Purpose and Overview

This chapter summarizes the results of the integrated analysis of the combined National Energy Strategy actions. These results are described in terms of differences from the Current Policy Base case discussed in Chapter 2. These differences were estimated using the analysis methodology detailed in Chapter 1. This chapter presents the detailed effects of the combined National Energy Strategy actions, including the 1990 Clean Air Act Amendments, on energy markets, the environment, and the economy. This case is referred to in this chapter as the "Strategy scenario."

This discussion of the detailed effects of the National Energy Strategy focuses on the effects of the total set of Strategy actions on consumption and production by fuels and end-use sectors. The conclusions presented are the result of the integrated analysis of these combined actions. Precise results for individual actions are not given. As noted in Chapter 1, the effects of individual actions often depend on what other policies are adopted; many actions affect not only energy supply and demand, but the effectiveness of other actions as well. Where other Strategy actions have a significant impact on the effectiveness of a specific action, those consequences are described. Chapter 4 provides a more indepth view of each action incorporated into the integrated analysis, including the estimated effects of each action when analyzed in isolation as well as the approximate effects attributable to each action when combined with all other actions in the Strategy. This provides the estimated range of potential effects for each action.

Impacts on Energy Supply and Demand

Total Energy Use

For the period between 1990 and 2030 as a whole, the United States is projected in the Strategy scenario to increase absolutely its consumption of primary energy (including what is used to generate electricity) at an average rate of just under 1.0 percent per year. This is substantially less than the 1.3 percent per year rate in the Current Policy Base case. Electricity consumption is also expected to rise much more slowly than in the Current Policy Base case; demand for electricity is 11 percent lower in 2010 and nearly 13 percent lower in 2030. This reduction is due to several actions, including integrated resource planning, building standards, and industrial efficiency research and development. Growth rates for basic energy factors are given in Table 3–1. (Table 2–1 provides these growth rates for the Current Policy Base case.) Quantity and price estimates for the Strategy scenario are summarized in Table 3.2. Total energy consumption and consumption by primary fuel are depicted in Figures 3–1 and 3–2.

Figures 3–1 and 3–2 indicate that the economy, as in the Current Policy Base case, is expected to become substantially more energy-efficient than it is today. All sectors—buildings, industry and transportation—are expected to be even more

Table 3–1. Growth Rates for Basic U.S. Energy Factors—Strategy Scenario

Period	Population	GNP	Primary Energy Demand	Electricity
1990-2000	0.7	3.2	1.6	2.5
2000-2010	0.5	2.8	1.1	1.5
2010-2020	0.4	1.9	0.8	1.6
2020-2030	0.2	1.7	0.5	1.3
1990-2030	0.5	2.4	1.0	1.7

Figure 3-1: Primary Energy Consumption
Strategy Scenario

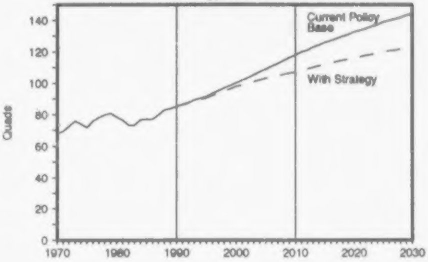
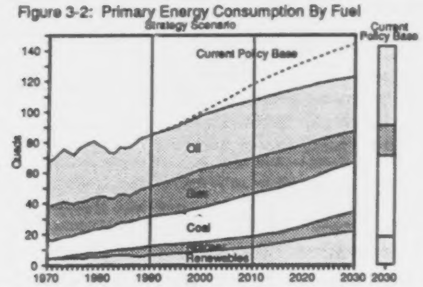


Table 3-2. Energy Summary - Strategy Scenario

	1990	1995	2000	2005	2010	2020	2030
Primary Energy Production (quads)							
Petroleum	17.6	15.8	18.3	21.9	21.4	15.0	10.9
Natural Gas	18.1	20.3	22.4	21.1	20.1	21.0	17.6
Coal	22.5	22.6	25.6	29.4	33.6	36.3	39.5
Nuclear	6.1	6.1	6.2	6.5	7.0	8.3	12.5
Renewables	6.8	7.8	9.0	10.3	11.8	17.2	22.3
Total Production	71.2	72.6	81.5	89.3	93.8	97.9	102.8
Net Imports (quads)							
Petroleum	15.4	18.9	17.6	15.4	16.6	22.7	24.8
Natural Gas	1.4	2.5	3.0	3.5	3.5	3.1	3.2
Coal	-2.6	-2.6	-3.3	-4.3	-5.8	-6.8	-7.2
Methanol and Electricity Imports	0.1	0.8	1.2	2.1	3.4	3.5	3.5
Total Net Imports	14.3	19.1	17.4	14.8	14.5	19.3	21.1
Primary Consumption (quads)							
Petroleum	33.5	34.7	35.9	37.3	38.0	37.8	35.6
Natural Gas	19.2	22.2	24.7	23.9	22.8	23.5	20.2
Coal	19.0	20.0	22.3	25.0	27.8	29.5	32.3
Nuclear	6.1	6.1	6.2	6.5	7.0	8.3	12.5
Renewables	6.8	7.8	9.0	10.3	11.8	17.2	22.3
Methanol and Electricity Imports	0.1	0.8	1.2	2.1	3.4	3.5	3.5
Total Consumption	84.8	91.7	99.3	105.3	110.8	119.7	126.5
End-Use Consumption (quads)							
Liquids	32.1	33.7	35.7	38.0	39.9	39.3	38.0
Natural Gas	16.3	17.0	18.1	18.1	17.8	16.9	16.4
Coal	2.8	2.8	2.9	3.3	3.6	3.6	3.5
Electricity	9.2	10.5	11.9	12.8	13.7	16.1	18.4
Renewables	3.0	3.0	3.4	4.0	4.8	7.8	10.0
Total Consumption	63.4	67.0	72.0	76.2	79.7	83.7	86.2
Energy Input to Electricity Generation (quads)							
Petroleum	1.3	1.6	1.0	1.1	1.1	1.5	0.7
Natural Gas	2.9	5.3	6.7	6.0	5.1	6.7	3.9
Coal	16.1	17.1	19.2	21.7	24.2	25.8	28.7
Nuclear	6.1	6.1	6.2	6.5	7.0	8.3	12.5
Renewables	3.7	4.8	5.6	6.4	7.1	9.4	12.3
Total Consumption	30.1	34.9	38.8	41.7	44.5	51.7	58.1
Energy Prices							
World crude oil ($1990/bbl)	22.00	20.89	27.52	30.39	33.33282	39.63087	42.69141
Wellhead natural gas ($1990/mcf)	1.77	2.54	4.17	4.45	5.48	7.06	7.85
Minemouth Coal ($1990/ton)	22.18	24.55	25.68	26.47	28.68	31.58	33.88
Average electricity ($1990/kWh)	0.065	0.067	0.071	0.074	0.075	0.077034	0.077034
Energy-Related Emissions							
SO2 (mill. tons/year)	23.3	18.3	14.7	15.2	15.1	14.9	12.7
NOx (mill. tons/year)	22.7	21.7	19.6	20.8	21.9	22.9	21.9
Carbon (mill. metric tons (MMT)/year)	1299	1376	1487	1573	1640	1710	1707
Global warming potential (MMT/year)	7458	7143	6843	7064	7233	7431	7082
Gross National Product (bill. $1990)	5463	6478	7474	8646	9626	11918	14062

Figure 3-2: Primary Energy Consumption By Fuel

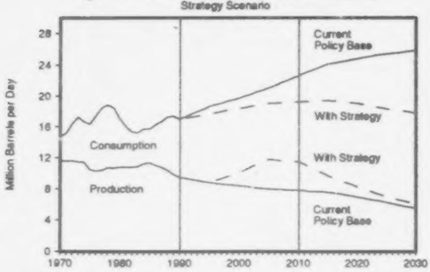


efficient than in the Current Policy Base case. Overall, the economy is projected to become 32 percent more energy-efficient in the Current Policy Base case and 42 percent more efficient under the Strategy scenario.

Oil

Under the Strategy scenario, domestic oil production increases significantly relative to the Current Policy future and in fact rises absolutely in the midterm. This turnabout is due to the initiatives in advanced oil R&D, access to the coastal plain of ANWR, and access to certain restricted Federal OCS areas. Oil consumption is lower due to the combined effects of alternative fuels, transportation efficiency R&D, natural gas regulatory reforms, and other oil demand-reduction actions. As a result of the higher production and lower consumption levels, oil imports are sharply lower than in the Current Policy Base case. These changes are depicted in Figure 3–3.

Figure 3-3: Oil Consumption and Production



Oil Production

The Strategy scenario projects U.S. crude oil and natural gas liquids production from domestic sources to rise from 8.8 million barrels per day (MMBD) in 1990 (excluding refinery gains) to 9.3 MMBD in 2000, 10.9 MMBD in 2005 and 10.6 MMBD in 2010. This represents about 3.8 additional million barrels per day of production in the 2005–2010 period relative to the Current Policy Base case. This large jump in production is the result of the three oil supply actions listed above. The advanced oil R&D action results in additional oil production, including secondary and tertiary oil recovery of about 3.0 MMBD in 2005 and 3.2 MMBD by 2010. This increase is the result of aggressive transfer of existing recovery technologies to geologic areas in which they have not been previously applied, as well as the commercialization of new technologies. The advanced oil R&D action also results in higher production from conventional lower 48 resources. Production from ANWR, based on the conditional mean resource level, reaches nearly 0.9 MMBD by 2005 and declines slowly thereafter. Production from the restricted OCS rises to 0.1 MMBD by 2010 and reaches 0.4 MMBD by 2015. This delay is caused by restrictions on Federal OCS access before 2000.

Oil Consumption

The Strategy scenario projects U.S. oil consumption to rise less rapidly than in the Current Policy Base case. Demand grows at an annual rate of only about 0.6 percent per year through 2010 (less than one-half the rate in the Current Policy Base case) and actually falls by 0.3 percent thereafter (versus a 0.8 per year increase). Total demand is estimated to rise from about 17.0 MMBD in 1990 to 18.4 MMBD in 2000, 19.2 MMBD in 2010 and fall to less than 18 MMBD by 2030. This represents savings relative to the Current Policy Base case of 1.3 MMBD in 2000, 3.4 MMBD in 2010, and 8 MMBD by 2030. This reduction in consumption is the result of the oil conservation and alternative-fuel actions listed above.

As noted in Chapter 2, the bulk of U.S. oil consumption occurs in the transportation sector; the majority of the oil demand reduction in the Strategy scenario is also in transportation. Alternative-fuel and transportation R&D actions, together with the Clean Air Act Amendments, result in 95 percent of the total oil savings. Overall passenger vehicle efficiency increases by 29 percent by 2010, and by nearly 80 percent by 2030 relative to 1990 levels. This is twice the rate of efficiency improvement by 2010 in the Current Policy Base and more than three times the rate by 2030. These long-term efficiency gains are due to successful development and market penetration of more efficient propulsion technologies after 2010. These efficiency gains are complemented by switching from oil to alternative fuels (including methanol and compressed natural gas) and substantial production of alcohol fuels brought about by the biofuels production R&D action. Alternative-fuel consumption resulting both from the Strategy alternative-fuel initiatives and the use of oxygenates in reformulated gasoline in response to the Clean Air Act Amendments reach 0.9 MMBD in 2000 and 2.2 MMBD by 2010.

Oil consumption is also reduced in other sectors. The natural gas actions result in somewhat less oil consumption in residential and commercial buildings as well as substantial switching from oil to gas in the electric utility industry.

The large reductions in oil consumption have only a minor impact on domestic oil production. This is because imported oil is the marginal source; all else equal, a reduction in demand will result in approximately equal reduction in imports. However, the increase in oil production is somewhat less in the Strategy scenario than when the oil supply actions are considered independently. This is due to the impact of the oil conservation and production actions on world oil prices, as discussed below.

Oil Imports

The large reductions in oil consumption, coupled with the higher production levels in the Strategy scenario, result in substantially lower U.S. oil import levels. Imports are projected to rise from an estimated 7.3 MMBD in 1990 to only 8.3 MMBD in 2000, 7.8 MMBD in 2010 and 11.6 MMBD by 2030. This represents a savings of 3 MMBD in 2000, 7 MMBD in 2010 and 8 MMBD in 2030, or put another way, over a 35-percent reduction in U.S. dependency on imported oil in 2010. The Current Policy Base case projects importing roughly 65 percent of the oil the nation uses in 2010 and nearly 80 percent in 2030. Under the Strategy scenario, the figures are about 40 percent in 2010 and 65 percent in 2030.

This substantial cut in U.S. demand for imported oil is projected to have a significant impact on world oil prices. Prices are expected to decline by over $1.55 per barrel (in 1990 dollars) in 2000 and more than $5.00 in 2010. This price decrease causes some backsliding in the effectiveness of conservation. Investments in energy-efficient capital stocks are somewhat lower than if prices were unaffected by the decline in U.S. oil imports. In fact, long-term industrial oil consumption rises slightly under the Strategy scenario as the decline in residual oil prices more than compensates for the availability of efficient capital stocks. However, substantial demand reductions still occur in the transportation sector due to more efficient vehicles and the widespread use of alternative fuels. This is an example of where the effects of the individual actions added independently is less than the combined effect due to supply and demand feedbacks.

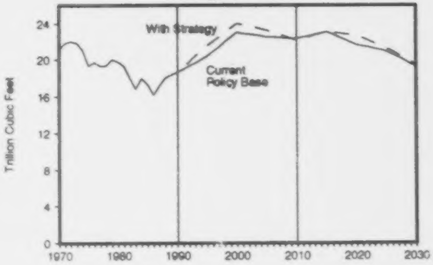
Natural Gas

Natural gas consumption increases significantly in the midterm and backs out a significant amount of oil use under the Strategy scenario, relative to the Current Policy Base case. This is because of the Strategy natural gas regulatory reforms actions. These changes are depicted in Figure 3–4.

Gas Consumption

The Strategy scenario projects gas consumption to rise in the short- and mid-term relative to the

Figure 3-4: Natural Gas Consumption
Strategy Scenario



Current Policy Base case. Total demand is estimated to rise from about 18.3 trillion cubic feet (tcf) today to 21.8 tcf in 1995 and 24.2 tcf by 2000, backing out significant quantities of oil in industry and electric utilities. Demand is projected to increase by about 1 tcf in both years relative to the Current Policy future. After 2005, gas consumption is slightly lower in buildings, industry and electric utilities in the Strategy scenario relative to the Current Policy Base case due to the effect of Strategy conservation actions. However, the share of gas in these markets is higher than the shares in the Current Policy Base case; the markets themselves are smaller, resulting in lower gas demand. Gas demand in the transportation sector increases relative to the Current Policy Base case as use of compressed natural gas (CNG) in fleet vehicles becomes more widespread due to the Strategy alternative-fuel actions. CNG consumption rises from negligible levels today to 0.3 tcf in 2000 and 0.5 tcf by 2010.

Domestic Gas Production

Gas production is driven by gas demand. Gas production is projected to increase under the Strategy scenario by 1.1 tcf in 1995 and 1.2 tcf in 2000, relative to the Current Policy Base case, essentially matching the increases in consumption. The natural gas regulatory reforms actions also stimulate production through pipeline certification reforms, deregulation of sales rates, and rate-design changes. The result is an increase in both gas production and transportation capacity and a drop in average gas production costs. These lower costs result in slightly lower gas prices in the midterm despite the higher production levels. These actions make it possible both to produce more gas and reduce consumer energy costs.[1]

The long-term increase in gas consumption attributable to the gas regulatory reform actions under the integrated Strategy is somewhat less than the increase resulting from the natural gas actions when they are analyzed in isolation. This is due principally to the lower overall demand for energy in the Strategy scenario caused by the conservation actions. In addition, nuclear power and renewable technologies reduce the use of gas for electricity generation in the long term under the Strategy scenario relative to under the gas actions alone. However, in the short term, gas consumption under the Strategy scenario is higher due to both the gas regulatory actions and higher CNG consumption in transportation resulting from the alternative-fuel actions. Production of gas, unlike oil, follows demand; changes in consumption generally result, after a time lag, in roughly commensurate changes in production. This is due in the short term to the excess production capacity and the fact that the North American gas market is essentially "closed" (that is, it is difficult to import significant quantities of gas outside of Canada and Mexico). Gas production is therefore higher in the short term and lower in the long term under the combined actions of the Strategy scenario than under the gas regulatory actions alone.

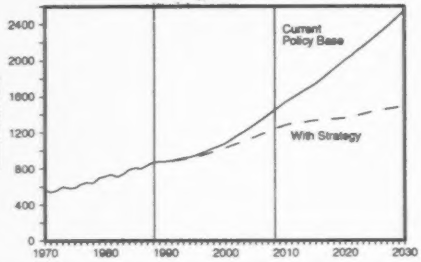
Gas Imports

Pipeline imports are largely unaffected by the Strategy actions. However, imports of liquefied natural gas (LNG) fall relative to the Current Policy Base case as more capital is invested in domestic production capacity and less in LNG facilities under the Strategy scenario. In the very long term, LNG imports are projected to still make a significant contribution as domestic gas supplies become more expensive.

Coal

With the resumption of orders for nuclear power plants, coal consumption falls sharply under the Strategy scenario relative to the Current Policy

Figure 3-5: Coal Consumption
Strategy Scenario



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[1] In microeconomic terms, the actions increase gas availability, shifting the natural gas demand curve to the right. The increased transmission access resulting from the actions also shifts the natural gas *supply curve* to the right. The result is a new equilibrium to the right and below the original equilibrium point, resulting in both lower prices and higher demand.

Base case. As shown in Figure 3–5, total coal consumption is projected to rise from 19.0 quads (893 million tons) today to 27.8 quads (1,309 million tons) in 2010, but only about 32 quads (about 1,500 million tons) by 2030. (In the Current Policy Base case, coal consumption nearly triples by 2030—reaching 55 quads, or nearly 2,600 million tons). Coal accounts for about 55 percent of electricity generation today, but by 2030 this share falls to only about 50 percent (versus over 75 percent in the Current Policy Base case). The Strategy clean coal technology actions accelerate the introduction of advanced clean coal electricity generation technologies such as pressurized fluidized-bed and integrated gasification combined-cycle plants. These new technologies greatly increase the efficiency of the still-substantial electric utility coal use and result in lower emissions of SO_2; NO_x, and carbon per ton of coal burned.

Clean coal technologies capacity is somewhat lower under the Strategy scenario than when the clean coal technology action is analyzed alone. Competition from nuclear and renewable technologies as well as lower electricity demand resulting from the integrated resource planning and conservation actions substantially reduces total coal capacity. The clean coal technologies continue to compete successfully for new market share, but the growth rate of the new capacity is somewhat lower. It is also worth noting that the availability of these technologies allows utility managers greater flexibility in meeting the emission-reduction targets of the 1990 Clean Air Act Amendments, especially in the 2000 to 2010 period before nuclear power makes inroads into the new base-load power market.

Nuclear Power

Nuclear power becomes a viable option for new base-load power under the Strategy. As shown in Figure 3–6, nuclear generation rises from about 575 billion kWh today to 650 billion kWh in 2010, and 1,195 billion kWh by 2030. This contrasts sharply with the Current Policy Base case, in which nuclear generation reaches 594 billion kWh in 2010 and falls to only 35 billion kWh by 2030. This nuclear capacity backs out substantial quantities of coal consumption, thereby greatly reducing carbon emissions in the long term.

Nuclear generating capacity is somewhat lower under the Strategy scenario than when the nuclear actions are analyzed alone. This is due to competition from clean coal and renewable technologies as well as lower electricity demand resulting from the integrated resource planning and conservation actions. Under either case, nuclear is projected to make a sizable contribution to reducing total carbon as well as other environmental emissions.

Renewable Energy

Renewable energy consumption, shown in Figure 3-7, increases substantially under the Strategy scenario, relative to the Current Policy future. Total renewable energy consumption, including electricity generation from renewable sources as well as biofuels consumption in transportation, is projected to increase more than 30 percent over the Current Policy Base case levels by 2030. This jump is due to a combination of measures including the municipal-solid-waste, hydroelectric regulatory

Figure 3-6: Nuclear Electricity Generation
Strategy Scenario

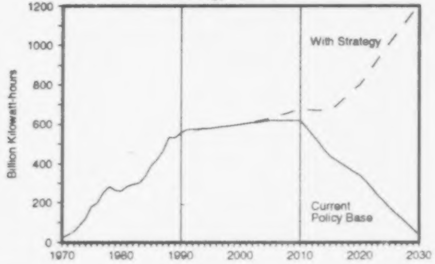
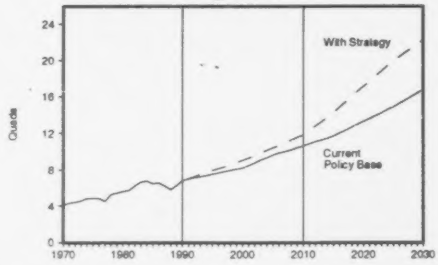


Figure 3-7: Renewable Energy Consumption
Strategy Scenario



reforms, biofuels production R&D, and transportation R&D actions.

Hydroelectric capacity is projected to significantly expand under the Strategy scenario. Problems with licensing new facilities and relicensing existing plants are expected to be resolved by the hydroelectric regulatory reform actions, and generation from many existing Federal hydro plants is increased through improved operation and maintenance and capacity additions. Base-load hydro capacity is projected to increase from about 78 gigawatts (GW) today to 81 GW in 2000, 87 GW in 2010, and 97 GW by 2030. This represents additional capacity relative to the Current Policy Base case of 3 GW in 2000, 9 GW in 2010, and 16 GW in 2030. Generation from these facilities is 12 percent higher in 2010 and 20 percent higher in 2030 relative to the Current Policy Base case.

Municipal solid waste capacity also increases significantly under the Strategy scenario. Capacity is projected to rise from about 4 gigawatts (GW) today to 28 GW in 2010 and 55 GW by 2030. This represents additional capacity relative to the Current Policy Base case of 14 GW in 2010 and 40 GW in 2030.

Alcohol fuels consumption expands substantially under the Strategy scenario. Demand is projected to be 0.5 quads in 2010 and 3.8 quads by 2030. This 2030 estimate is over a sevenfold increase from the Current Policy Base case. This rapid increase in biofuels consumption is a result of new vehicle technologies brought about through the transportation R&D actions, lower production costs for alcohol manufacture because of the biofuels production R&D action, and higher demand for alcohol fuels caused by the alternative fuels actions.

Overall, the renewable energy contribution rises from about 8 percent of U.S. primary energy consumption today (6.8 quads) to 18 percent (22 quads) by 2030 under the Strategy scenario—as opposed to 12 percent (17 quads) by 2030 in the Current Policy Base case.

Electricity

Electricity consumption rises more slowly under the Strategy scenario than under the Current Policy Base case. Total consumption, shown in Figure 3–8, is expected to rise from 2,700 billion kWh (9.2 quads) today to about 4,000 (13.7 quads) in 2010 and 5,300 billion kWh (18.4 quads) by 2030 under the Strategy scenario. This is an 11-percent reduction in 2010 and a 14-percent reduction by 2030 relative to the Current Policy Base case. This substantial cut in future electricity demand is caused by the integrated resource planning, building standards, and industrial efficiency R&D actions. Reductions in electricity also substantially cut future primary energy demand; energy inputs to generation fall by 4.5 quads in 2010 and about 7 quads in 2030 relative to the Current Policy Base case.

The mix of fuels used to generate electricity is projected to change substantially in the long term under the Strategy scenario as compared to the Current Policy Base case. This is shown in Figure 3–9. In 2010, the share of coal is projected to drop from 59 percent (28.9 quads) without the

Figure 3-8: Electricity Consumption
Strategy Scenario

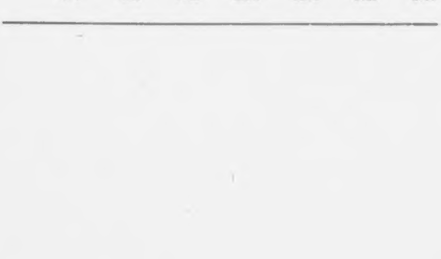
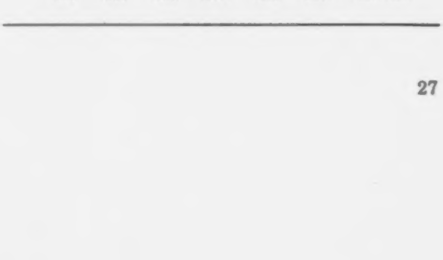


Figure 3-9: Fuel Inputs to Electricity Generation
Strategy Scenario



Strategy to 54 percent (24.0 quads) with the Strategy, while nuclear increases from 13 percent (6.4 quads) to 16 percent (7.0 quads) and the renewables share jumps from 13 percent (6.0 quads) to 18 percent (7.1 quads). By 2030, the coal share falls from about 75 percent (50 quads) to 49 percent (29 quads), while the nuclear share leaps from 1 percent (0.4 quads) to 22 percent (12.5 quads) and the renewables share grows from 16 percent (9.4 quads) to 26 percent (12.0 quads). The result of the Strategy actions is a more balanced and hence potentially more reliable electricity generation system.

Residential Energy Use

Energy consumption in the residential sector falls only about 4 percent relative to the Current Policy Base case, but the fuel splits change significantly under the Strategy scenario. Primary energy use (including the losses incurred generating the electricity used in this sector) is depicted in Figure 3–10. Primary energy use is projected to rise from 18.2 quads in 1990 to 22.1 quads in 2010 and 25.4 quads by 2030. This rate of growth is less than the rate without the Strategy.

The natural gas reforms and buildings standards actions result in some oil use being backed out by gas. However, the prices of petroleum fuels are significantly lower under the Strategy scenario because of the impact of the oil conservation and production actions; for this reason, slightly less oil is backed out than would be the case if these actions were implemented in isolation. In addition, electricity consumption falls due to the conservation actions and integrated resource planning.

Commercial Energy Use

Energy consumption in the commercial sector falls only slightly relative to the Current Policy Base case, but, as in the residential sector, the fuel splits change significantly under the Strategy scenario. Primary energy use, depicted in Figure 3–11, is projected to rise from 13.8 quads in 1990 to 20.5 quads in 2010 and 27.7 quads by 2030. This rate of growth is again less than the rate without the Strategy; the average commercial building is 20 percent more efficient on an end-use basis in 2010 than in 1990 and 25 percent more efficient by 2030.

The natural gas and buildings conservation actions result in some oil use being backed out by gas. Again as in the residential sector, lower oil prices result in less oil being backed out than would be the case if the natural gas actions were implemented in isolation. Electricity consumption also falls due to the conservation actions and integrated resource planning.

Industrial Energy Use

The industrial sector is projected to continue to realize the greatest efficiency gains among the four end-use sectors. Average efficiency is expected to be 33 percent higher in 2010 than today and nearly 50 percent (versus 40 percent higher without the Strategy) in 2030. The efficiency gains beyond those in the Current Policy Base case are the result of the enhanced industrial efficiency R&D and integrated resource planning actions. Under the Strategy scenario, the industrial sector is projected to be, on average, 10 percent more efficient in 2010

Figure 3-10: Residential Primary Energy Consumption
Strategy Scenario

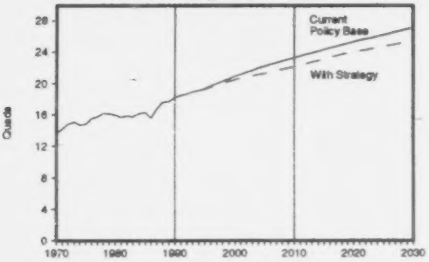
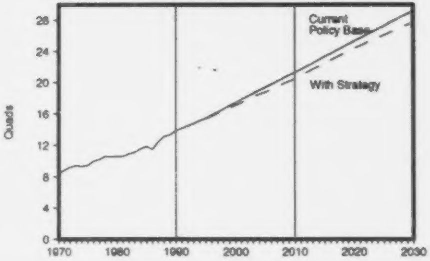


Figure 3-11: Commercial Primary Energy Consumption
Strategy Scenario



and 15 percent more efficient in 2030 than under the Current Policy Base case. Total primary industrial energy consumption is still projected to rise, but more slowly than without the Strategy scenario. As depicted in Figure 3–12, primary consumption increases from 32 quads in 1990 to 40 quads in 2010 and about 47 quads by 2030.

Unlike the residential and commercial sectors, the share of oil use in industry is projected to continue to rise as residual fuel competes favorably with gas as a boiler and cogeneration fuel because of lower world oil prices resulting from Strategy actions. In fact, industrial oil consumption is slightly higher under the Strategy than in the Current Policy Base case. This is due to the fact oil consumption and world oil prices are substantially lower under the Strategy, resulting in a steep drop in the price of industrial residual fuel. Industrial oil consumption is projected to rise from 4.1 MMBD in 1990 to 5.6 MMBD in 2010 (versus 5.3 MMBD in the Current Policy Base case).

The rate of growth in electricity consumption, however, is projected to be substantially lower than without the Strategy scenario. This is the result of both the integrated resource planning action and the enhanced industrial efficiency R&D actions. Electricity as a share of total industrial end-use consumption is projected to remain in the range of 13 to 15 percent.

Transportation Energy Use

Transportation oil consumption rises far less quickly over the next 20 years and then actually falls thereafter under the Strategy scenario; nonpetroleum fuel use (CNG, alcohol, electricity) becomes more widespread through the alternative-fuel actions and vehicle efficiencies rise because of the transportation R&D action. As shown in Figure 3–13, oil demand is projected to rise from 21.4 quads (11 MMBD) in 1990 to 23.8 quads (12 MMBD) in 2010 (vs. 30.4 quads, or 15.4 MMBD, without the Strategy), resulting in an estimated oil savings of 3.4 MMBD in 2010. After 2010, transportation oil consumption (excluding imported methanol) falls to 19.2 quads (9.7 MMBD) by 2030 (as opposed to rising to more than 35 quads, or 18 MMBD, in the Current Policy future). This reduction represents most of the reduction in total oil consumption under the Strategy and is the single largest contributor to the projected decrease in oil imports.

Alternative fuels (including methanol, oxygenates in reformulated gasoline, domestic alcohol, and CNG) consumption is projected to rise substantially. Total alternative-fuel consumption is expected to rise to 2.2 million barrels per day of crude oil equivalent (MMBDOE) in 2010 and about 3.9 MMBDOE by 2030. Imported methanol consumption rises to 1.7 MMBDOE by 2010 and remains fairly constant thereafter as domestic alcohol production becomes economical. Domestic alcohol consumption rises to 0.2 MMBDOE in 2010 and 1.8 MMBDOE by 2030—roughly five times the level without the Strategy. Nonpetroleum oxygenates in reformulated gasoline (made from imported methanol, domestic alcohol, and natural gas) reach 0.6 MMBDOE in 2010 but decline to about 0.4 MMBDOE by 2030 because of lower total gasoline consumption by 2030. Compressed natural gas use increases from negligible levels today to

Figure 3-12: Industrial Primary Energy Consumption
Strategy Scenario

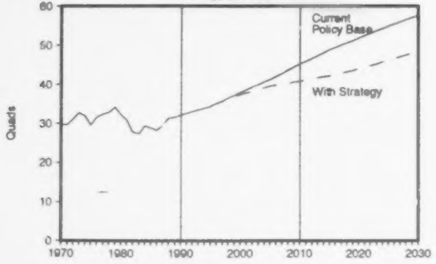
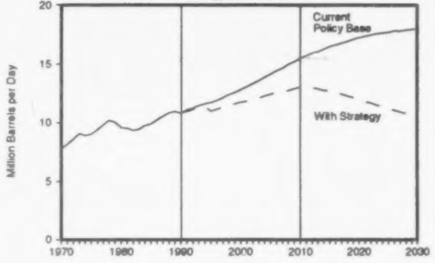


Figure 3-13: Transportation Oil Consumption
Strategy Scenario



about 0.3 tcf in 2000 and 0.5 tcf by 2010. Electric-vehicle consumption rises from near zero to 0.1 quads in 2010 and 0.4 quads by 2030.

These reductions in oil consumption are due to the Strategy alternative-fuel, biomass production R&D, and transportation R&D actions, as well as the Clean Air Act Amendments. The Strategy alternative-fuel actions are responsible for most of the midterm increases in alternative-fuel consumption, while the Clean Air Act Amendments cause the widespread use of reformulated gasoline and about 0.1 MMBDOE of alternative-fuel use by 2010. In the longer term, the transportation R&D actions result in substantially higher fuel efficiencies in the sector. Overall fleet passenger on-road vehicle efficiency (as compared to new-vehicle fleet efficiency) is projected to rise to 24 mpg in 2010 and 34 mpg by 2030. This is 14 percent higher in 2010 and 45 percent higher in 2030 than without the Strategy. In addition, the enhanced transportation R&D actions cause additional demand for alternative fuels after 2010 as new vehicle propulsion technologies using alternative fuels (for example, electric cars, gas turbines) enter the marketplace.

Impacts on the Environment

Greenhouse Gas Emissions

Emissions of greenhouse gases that may contribute to potential global climate change fall substantially relative to the Current Policy future. This is due to the combination of new nuclear power plants, the expanded use of renewable resources, electricity conservation through integrated resource planning, and conservation actions in buildings, industry, and transportation. As shown in Figure 3–14, total greenhouse gas emissions, measured in terms of global warming potential, are estimated to stay at or below 1990 levels through 2030. Greenhouse gas emissions are actually projected to decline from 1990 levels after 2015, reaching a level nearly 10 percent below 1990 by 2030. However, given the extremely speculative nature of such long term projections, the Strategy speaks in terms of holding emissions at or below current levels through 2030.

Emissions of Air Pollutants

Emissions of sulfur dioxide (SO_2) fall sharply in the Strategy scenario primarily because of the Clean Air Act Amendments of 1990 (CAA Amendments), especially in the near term. Over the long term, however, the Strategy would reduce SO_2 emissions even beyond the substantial reductions driven by the CAA Amendments due to electricity conservation, natural gas regulatory reform, clean coal technology, and nuclear power. Relative to 1990 SO_2 emission levels, there is a 35-percent decrease in emissions by 2000, contrasted with a growth in emissions of 7 percent in the Current Policy Base. By 2030, relative to the Current Policy Base case, the Strategy actions result in a 45-percent lower SO_2 emission rate. One result of the Strategy is that electric utilities have more flexibility in meeting the emissions target of the CAA Amendments. Moreover, since electricity demand is substantially lower than in the Current Policy Base case, the cost of compliance may be somewhat reduced. SO_2 emissions are presented in Figure 3–15.

Figure 3-14: Global Warming Potential
Strategy Scenario

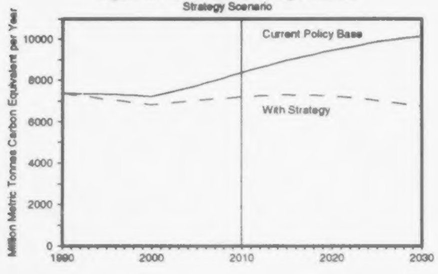
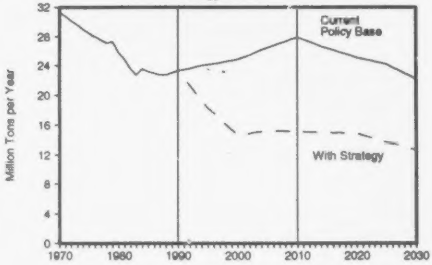


Figure 3-15: Sulfur Dioxide Emissions
Strategy Scenario



Nitrogen oxide (NO_x) emissions are projected to be substantially lower under the Strategy scenario. Relative to 1990 emission levels for NO_x, there is a 13-percent drop by 2000, again primarily because of the CAA Amendments. By 2010, however, increased transportation oil use and electricity consumption result in NO_x levels only 4 percent lower than in 1990. Compared with the Current Policy Base case, NO_x emissions are 15 percent lower in 2010 as a result of Strategy actions, including the CAA Amendments. NO_x emissions are presented in Figure 3–16.

Emissions of volatile organic compounds (VOC's) associated with urban smog are also expected to fall under the Strategy. Relative to 1990 levels, VOC emissions are projected to be 24 percent lower by 2000, largely due to the CAA Amendments. With increased transportation energy use by 2010, VOC levels are projected to rise, but will still be 17 percent below 1990 levels. Compared with the Current Policy Base case, the Strategy actions, including the CAA Amendments, result in a 14-percent reduction in VOC emissions by 2000 and a nearly 20-percent drop by 2010. VOC emissions are presented in Figure 3–17.

Impacts on the Economy

The economic objectives of the National Energy Strategy are to maintain an economy that is second to none and to reduce the economy's vulnerability to energy supply disruptions. The National Energy Strategy results in both economic growth and reduced vulnerability.

The impacts of the Strategy on the U.S. economy are projected to be positive. On the basis of analysis using the integrating macroeconomic model, real GNP (in 1989 dollars) is projected to be about $25 billion higher by 2000 than without the Strategy. By 2010, this improvement in economic output is projected to exceed $35 billion. The cumulative effect of the Strategy on the U.S. economy can be evaluated by the net present value of the increase in GNP. Figure 3–18 shows the increase in net present value of GNP (discounted at 10 percent per year) for the periods 1990 to 2000 and 1990 to 2010. For the first 10 years, the net present value of GNP is projected to be about $60 billion higher than the Current Policy Base case. With the Strategy in place for an additional 10 years, the net present value of GNP is projected to be about $150 billion higher than without the Strategy. This higher economic growth under the Strategy is due to higher levels of production activities in the oil and gas industry, lower oil imports, improved energy efficiency, and lower energy prices.

Production of both oil and natural gas is projected to increase under the Strategy. Oil production in 2000 is projected to be 1.7 MMBD higher than without the Strategy. By 2010, the increase in oil production is about 3.8 MMBD. These increases result from the advanced oil R&D, ANWR access, and OCS access actions. By 2010, additional oil revenues from these three sources are estimated to exceed $20 billion (in 1990 dollars). These activities will create thousands of jobs as well as raise State and Federal tax revenues.

The Strategy will also reduce oil imports because of the combination of increased domestic oil pro-

Figure 3-16: Nitrogen Oxides Emissions
Strategy Scenario

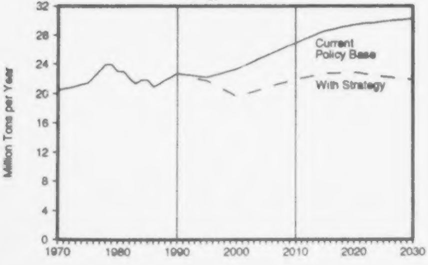


Figure 3-17: Volatile Organic Compounds Emissions
Strategy Scenario

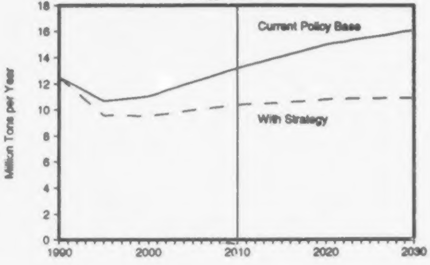


Figure 3-18: Increases in Gross National Product
Strategy Scenario

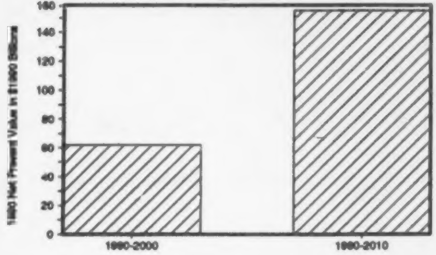
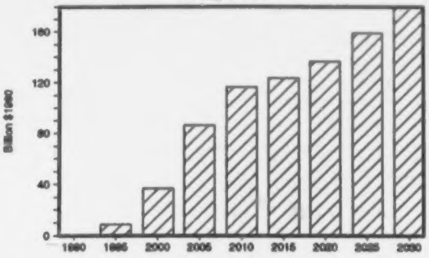


Figure 3-19: Savings in Imported Oil Expenditures
Strategy Scenario



duction and reduced oil consumption. This translates into an estimated savings in the U.S. imported oil bill of about $8 billion in 1995. By 2000, the savings are projected to exceed $35 billion. Figure 3–19 shows the projected savings in imported oil expenditures over the next 40 years. Savings in the imported oil bill will improve domestic economic activity as the savings can be used to purchase goods and services produced domestically and stimulate the domestic economy.

The Strategy also enhances the U.S. economic position by improving technologies in both energy-consuming and producing sectors. Transportation- and industrial-sector efficiency is advanced as a result of the R&D actions. Technologies both for oil and gas production and electricity generation are improved. Gradual adoption of these more energy-efficient technologies reduces energy consumption and frees up capital, which can then be invested to improve productivity in other sectors of the economy.

The Strategy also reduces energy costs to consumers. Compared with the Current Policy Base case, crude oil prices decline about $1.70 per barrel (in 1989 dollars) in 2000, and about $5.00 in 2010. Prices of natural gas and coal are lower under the Strategy as well, reflecting lower energy consumption levels.

The Strategy also results in economic benefits that cannot be easily quantified. For example, the infrastructure required to import and refine crude oil will be smaller. As a result, environmental risks associated with oil imports are expected to be lower.

The improvements in energy security are difficult to quantify, but provide very real benefits to the economy. Energy security measures the vulnerability of an economy to a disruption in the world oil market. For a supply disruption of a given size, the impacts on world oil prices would be smaller if total demand for oil was relatively smaller or if total world supply of oil was relatively larger due to the use of strategic reserves or excess production capacity. As detailed previously, U.S. oil imports decrease by more than 3 MMBD in 2000, about 7 MMBD in 2010 and more than 8 MMBD by 2030. Additional benefits of the Strategy derive from diversification of end-use energy consumption and electric generation. With the Strategy, the potential impacts on the economy of supply disruptions of one type of energy would likely result in smaller economic dislocations.

In summary, the macroeconomic analysis of the National Energy Strategy indicates that the reduced energy costs and improvements in energy security and energy diversity have a significant positive impact on economic growth.

Senator **Bingaman**. Okay.

The other thing which I would be interested in getting your views on is, I guess in the 1980 bill Senator Johnston put the requirement in the law or proposed a requirement and the Senate adopted it, and the Congress did, and the President signed it, calling upon the Department of Energy to submit these targets each 2 years, each odd-numbered year.

And I gather that never was done. Is that accurate?

Mr. **Saba**. We submit what we refer to as projections.

Senator **Bingaman**. But have you submitted projections each odd-numbered year?

Mr. **Saba**. We do. I would not say they were exactly on time in the February time frame.

Senator **Bingaman**. Have you submitted some this year? This is an odd-numbered year.

Mr. **Saba**. I believe that they were signed and have been delivered within this past week.

Senator **Bingaman**. Have we received them? To whom do you submit them?

Mr. **Saba**. They are submitted to the Speaker of the House and the President of the Senate, and then distributed to committees.

Senator **Bingaman**. But you do have those projections and they have been delivered to us in the last week?

Mr. **Saba**. The Secretary signed them out, I believe, 2 days ago. So they may not have been actually physically delivered or they may have just gotten here.

Senator **Bingaman**. Let me just explore for a minute this distinction between setting targets and making projections. What is that distinction here?

Is there some ideological objection to saying that we should do things in the energy area? Is that the problem? I mean, you do not like to use the word should, we use the word will, instead. Is that it?

Mr. **Saba**. We use the word "projections." But yes, I think it comes down to once you set targets, what are they to be used for? Are we then committing to mechanisms to achieve those targets? And it does, at some level, become an issue of the ideology.

Senator **Bingaman**. But you would agree, I guess you would agree that the whole purpose of adopting S. 1220 is to achieve certain objectives. We are not doing this for our health.

Mr. **Saba**. No, and we set out those objectives in the National Energy Strategy, broad objectives.

Senator **Bingaman**. So you are agreeing that we should try to achieve those objectives. And in order to do so, we should adopt S. 1220?

Mr. **Saba**. Yes. Let me clarify the administration's position on S. 1220, which is that there are many provisions in the bill that we support. There are some provisions that we do not support and we have not taken an official position on the bill per se. But it is very similar to the legislation that was submitted by the administration.

Senator **Bingaman**. Okay. Just taking the administration's proposed bill, you have no problem with the proposition that that administration proposal is intended to achieve certain concrete objectives?

Mr. SABA. Correct.

Senator BINGAMAN. And whether you call those targets or projections, it is something we are consciously setting out to try to achieve. Not necessarily that we are going to get it done, but this is our best shot.

Mr. SABA. Again, what it is intended to achieve are some broad policy objectives. From that, we are then able to project the results of the specific measures.

But it was not that we took these projections first and said that we would build this strategy to achieve those.

We have general broad objectives as far as increasing efficiency, improving energy security, and the environmental ones.

Senator BINGAMAN. My frustration on it is, if I just tell my staff that I want them to do better, it is sort of hard for them to know whether they are getting the job done and it is sort of hard for me to know whether they are getting the job done a month from now. I need to be a little more specific and say we need to reduce the turnaround time for mail in our office from 10 days to 8 days. Then, you have something that we can both sit down and see whether or not we are getting it done.

It would not seem to me to be too great a leap for the administration to acknowledge that there is no accountability if you just say we are going to try to be more efficient. That is a prescription for total lack of accountability in case none of this works.

Mr. SABA. I guess there are certain areas in efficiency, for instance, where accountability in, as far as specific targets, is proper.

One is that the President has put out a Federal Executive Order on Federal energy management. And we did set specific goals or targets there. But that was an area that was under our control. And if we do not achieve those energy targets, then the administration should be properly held accountable.

Now if we set a target for renewable energy that we want to have 14 percent in the year 2010 and that is not achieved because renewable energy is not cost-effective or we determine later on that the increase in hydro power that would be required to meet that is not proper, I am not sure that the target in that case is a proper thing for the administration to be held accountable against.

Senator BINGAMAN. I have just been handed a document which was given out, I guess, at the press conference when you announced the National Energy Strategy or when Secretary Watkins did.

And it says estimated results in 2010. The estimated results of the National Energy Strategy are to reduce oil imports from 65 percent to between 40 percent and 45 percent. So that is a specific goal.

Mr. SABA. It is the result of these actions. It is a projection, as I said. It is a result. It is not a target that we set out to achieve when we built the energy strategy.

Again, it is this issue of ground up versus top down. It is an outcome. And we have the same debate in the global climate area. There are a number of countries out there that want to set goals or targets for CO_2 emissions or greenhouse gas emissions.

Greenhouse gas emissions as an outcome of the energy strategy, basically reaches stabilization. But we did not set out as a goal or a target to achieve stabilization.

Senator **Bingaman**. Now, that is just a disagreement about what the goal is, is it not? Stabilization is a goal. I mean, it is a pretty doggone specific quantitative goal, is it not?

Mr. **Saba**. If that was the goal, the scientific uncertainties and the remaining issues that surround the issue of climate change are such that we do not believe it is proper to set a goal or target that would say that we should stabilize greenhouse gases.

Now we took a number of measures——

Senator **Bingaman**. But that is because of uncertainty about the science, as I understand it. Is that not right?

Mr. **Saba**. And there are similar uncertainties in economic and other areas that also make goals or targets in energy areas similarly inappropriate.

The result of the National Energy Strategy to actually achieve that outcome was the building upon these other measures, separately, all these individual measures improving energy efficiency and enhancing environmental quality, reduced projected emissions.

Then when we sat back down at the end of the process and calculated greenhouse gas emissions we saw that in combination with a number of other administration actions, that the result of that would be to keep them at or below 1990 levels.

Senator **Bingaman**. You have said that you are expecting to issue another national energy strategy every 2 years and to be up here testifying or having the department here telling us how we are doing in meeting these projections or whatever you want to call them. Should we not have something in the law that directs you to do that?

Mr. **Saba**. We do in the national energy policy plan.

Senator **Bingaman**. There is nothing in S. 1220, is there?

Mr. **Saba**. The amendment by Senator Wirth, which requires us to do this least cost plan and submit that as the first national energy policy plan, requires us to submit this item.

Senator **Bingaman**. It requires you to submit updates as to where we are on these various areas?

Mr. **Saba**. I would have to look at the act to see if it contains specific provisions as far as requiring us to include where we are.

Senator **Bingaman**. I am still a little confused.

You say you are very pleased that we are repealing section 3 or title III, which required you to give us targets over the last decade. And yet you are planning to go ahead and give us updated projections every 2 years.

Mr. **Saba**. One of the reasons that we are so pleased that the energy targets provision is proposed to be repealed is that as part of the National Energy Strategy we do provide these projections. And so to a certain extent it is redundant.

Senator **Bingaman**. And your understanding of S. 1220 is that there is a requirement in there that you keep doing this?

Mr. **Saba**. The DOE Organization Act requires us every 2 years to submit a national energy policy plan. S. 1220 provides that the first one after passage of the bill be a least cost plan. And we believe that is the kind of approach that we should be taking in this energy area.

Senator BINGAMAN. My reading of this thing is that all you are required to do in this provision is to identify priorities, least-cost energy strategy shall identify Federal priorities for encouragement of the use of energy and energy efficiency resources.

I do not think that is what I am talking about or what we are trying to do in S. 1018. S. 1018 is trying to say, okay, what is the benchmark we were aiming to achieve and are we getting there or not? Or do we need to rethink our policy options? That is all I am trying to say. It does not seem to me to be a communist plot to suggest that we should have some idea of where we are trying to go and then look at whether or not we are getting there as we proceed.

I guess your position is that this is something the administration would rather not do. Is that right?

Mr. SABA. I would say that generally, yes. We do not have a problem with keeping score or measuring our progress towards these general goals. But as far as measured against specific targets, we do not think that is appropriate.

Senator BINGAMAN. You have this National Energy Strategy estimated results in 2010. What if we asked you to take S. 1220 and give us estimated results in 1995, 2000, 2005, 2010, each of the years we talk about in the bill in these same areas? Would that be something you could do for us?

Mr. SABA. We would be very happy to that. I think the results would be fairly similar, but we could do that.

[The information referred to follows:]

The following table presents the estimated results for S. 1220 for the years requested:

	1995	2000	2005	2010
Efficiency (GNP/quads)	71	75	82	88
Percentage of target	98	93	88	81
Renewables (percent of total)	8.4	8.6	9.5	9.9
Percentage of target	93	86	79	70
Oil consumption (percent of total)	37.9	36.7	36.8	36.2
Percentage of target	103	101	95	91
Oil imports (percent of total oil)	55	50	43	47
Percentage of target	92	101	115	106

Senator BINGAMAN. That would be very useful, if you would get that information. Then we would have a better idea of what you expect we would accomplish if we did enact the bill as it has come to the Senate floor.

Senator Murkowski, go ahead.

Senator MURKOWSKI. Thank you, Mr. Chairman.

Mr. Saba, my remarks will be very limited. Mr. Chairman, I note in your opening statement that you addressed the necessity of reaching a consensus on what energy legislation should or should not do. And I would certainly agree with you that we have not reached a consensus.

I guess my view would be that it is very unlikely that we could, for example, treble the price of gasoline domestically. Quite clearly it would have an effect, a dramatic effect on utilization and conservation. But clearly, the American public, I do not think, is politically ready to swallow that type of medicine.

The Senator from Alaska looks at a broader view in the sense of while targets are an admirable objective, the realization is that we are going to need more or less all of the above. We are going to need conservation. We are going to need production. And as a consequence of that it is my consensus that the energy bill reported out of committee more or less represents the prevailing attitude that the glass is either half full or it is half empty.

For those that are of the extreme environmental community there is great general criticism that we might as well trash it because there are no CAFE standards in it. And there is ANWR, which represents a point of view that clearly suggests that there is no conservation in the sense of CAFE. But there is production increases in the sense of ANWR.

Yet others look at it from the standpoint that we have never gotten so far in the development of a comprehensive piece of legislation, which I think is what Senator Bennett Johnston has been attempting to develop here. The question is whether the Congress wants to take on what has been done and improve on it or not.

But I guess, in all deference to you, Mr. Chairman, I feel that while goals are commendable, the ability to reach a consensus on the goals that the American public will stomach are just not reasonable. The American public, you know, wants energy. They want air conditioning. And they are used to turning on the lights and getting it. And the thought process that goes on behind where it comes from is a job that you and I have. Obviously, if they do have the luxury of relatively cheap energy, why there is going to be a hue and cry from the hinterland as to why Government does not provide it.

With that profound observation, Mr. Chairman, I wish you well with your hearing and with your witnesses and commend you for the clear objective of trying to set goals.

But goals, by their very nature imply consensus. And I just unfortunately do not see a consensus coming from the American public who has become used to relatively inexpensive energy and all the good things it provides.

And you know when we see a situation develop like the Persian Gulf and suddenly a supply of oil is threatened that we have become dependent on, as a consequence of our dependence on 50-some percent imported oil, why there is a hue and cry when the price goes up, why did Government not do something and why are we so dependent.

And you can bet your boots, Mr. Chairman, that the Mid East has figured us out. We are addicted to their cheap oil. And they are going to keep the price down so that we will keep continuing to import vast amounts to serve the public with relatively cheap energy.

And so I guess my perception is that we should take what we have here and try to improve it as opposed to the alternative, which clearly is to kill this bill and then have nothing and then have to start all over again.

Thank ~~you for the~~ opportunity to make that short statement, Mr. Chairman.

Senator BINGAMAN. Thank you.

Mr. Saba, we could have other questions. And I appreciate your willingness to be here. We have some other witnesses and maybe we need to move on to them.

Mr. SABA. Thank you.

Senator BINGAMAN. Thank you very much.

Let me ask Dr. Blair from the Office of Technology Assessment and Mr. Bill Chandler to please come forward.

Dr. Blair, why do you not go first and summarize your statement, if you would. We will include your statement in the record.

STATEMENT OF DR. PETER D. BLAIR, PROGRAM MANAGER, ENERGY AND MATERIALS, OFFICE OF TECHNOLOGY ASSESSMENT

Dr. BLAIR. Thank you, Mr. Chairman.

Thank you for the opportunity to testify today on the Nation's progress toward energy security and to discuss S. 1018, the Energy Goals Act of 1991.

As you noted earlier, Mr. Chairman, OTA has appeared before this and several other committees suggesting that a systematic, comprehensive energy policy would be well served by including a set of specific, but flexible goals against which the contribution of proposed policy ~~actions~~ can be measured. In short, if we do not know where we are headed it does not matter much how we get there.

Last fall we testified before this committee that the goals and establishing procedures for measuring progress in energy policy are particularly important now because the nature of energy policy concerns in the United States have evolved considerably in the almost two decades since the first Arab oil embargo.

Throughout the 1970's concern about energy price and availability spurred development of a wide range of new energy supply and demand technologies. In the 1990's energy policy concerns will focus less on the price and availability, as in the 1970's, and more on factors such as regional and global environmental quality, the impact of oil imports on our balance of payments, international competitiveness, national security, cost of imported oil supplies, and interactions with other social, economic, and environmental policies.

While none of these factors can at present be conclusively proved to mandate major policy changes, long-term trends such as those in oil imports or in CO_2 emissions from fossil fuels are alarming enough that it would be foolhardy to ignore them.

In particular, a comprehensive strategy national energy policy cannot be viewed merely as an end in itself. Just as energy is useful insofar as it provides needed services, energy policy is a function of broader and more fundamental national goals such as economic vitality, environmental quality, and national security.

Congress is ~~now~~ considering the President's National Energy Strategy and a wide range of other energy-related proposals. In evaluating various options reflected in these proposals, it is important to weigh them in the context of these overarching goals. Some energy options support all three goals, particularly those that improve efficiency, production, and use. Others can have conflicting results.

S. 1018 focuses on energy security goals and carbon emissions from energy sources. It suggests goals of reducing oil imports, increasing energy efficiency, and reducing carbon intensity through accelerated development and the use of renewables. Let me address each of these briefly.

U.S. dependence on oil imports is of increasing concern. In 1990 the bill for oil imports amounted to $65 billion, well over half of our total balance of payments deficit. Unless major steps are taken, that dependence will grow substantially. High levels of oil imports do not, by themselves, lead to poor trade balances. Japan is one counter-example. But such a high cost warrants strenuous efforts to insure that oil is used with optimal efficiency.

Figure 1 in my statement, which you have seen before, shows that our oil import dependence will rise to about 65 percent in the year 2010 in the base case, which is actually fairly similar to the Department of Energy's projection, which is in their Annual Energy Outlook. These are the 1990 figures that are reflected in this chart. 1991, I understand, has come out recently.

S. 1018 proposes holding U.S. oil consumption to 33 percent of total energy use by 2010 and holding imports to 50 percent of total oil use. The former would be much less challenging than the latter. Electricity and natural gas are likely to replace many uses of oil over the next decades, reducing oil's fraction of the total energy use from 40 percent in 1990 to 37 percent by 2010.

With no policy action due to declining domestic production, many forecasters, including the Department of Energy, expect oil imports to rise substantially to nearly 65 percent by 2010. The 50 percent import goal is challenging and would require substantial commitments from both supply- and demand-side options, as you noted earlier in our figure 2. That includes both many of the supply side options and the demand side options that you discussed with Mr. Saba.

Various studies over the past decade have shown that energy efficiency is an essential cornerstone to a comprehensive energy policy frame work. About two-thirds of the falling U.S. energy intensiveness, that is the energy use per dollar of GNP, of the last decade is attributable to improved energy efficiency in energy conversion and use in every sector of the U.S. economy.

Figure 3 in the statement show that trend and energy intensity in the U.S. economy over the last several decades. Considerable future energy efficiency gains are possible in all sectors of the economy using existing technology. And even greater cost savings and efficiency gains are possible with technologies under current R&D. An efficiency goal of sustained improvement of 20 percent per decade for the next two decades is ambitious, but realistic for the United States.

A combination of increased research on energy efficiency, increased investment in efficient equipment, and policy leadership can meet or exceed the 20 percent improvement per decade at less cost than pursuing many supply-side options.

Moreover, pursuing such a goal supports all three of the policy interests that I mentioned earlier.

Let me briefly address renewable energy. With no policy action, renewable energy as a percentage of total energy use is projected by many analysts to rise from 8 percent currently to 10 percent by the year 2010. S. 1018 proposed a 14 percent goal for 2010, which is a realistic challenge, perhaps even modest.

This goal, coupled with accelerating use for natural gas, which many researchers view as a bridge fuel to biofuels and other alternatives, especially in electric power production and possibly in transportation, could prime the pump of moving beyond the fossil fuel era.

However, this goal will not be met unless it is established now because a long time is required to effect the major turnover of capital stock of energy as well as consuming equipment.

An important lesson of the 1970's and 1980's is that energy goals are not very useful unless they are flexible, that is, can be addressed by a variety of options and can be modified if warranted as circumstances change. S. 1018 provides for determining appropriate measures of energy efficiency, acquisition of necessary data to gauge the level of energy efficiency by those measures, and the contingency for modifying energy objectives for reduced oil consumption, energy efficiency, and commercial use of renewables, if changed circumstances warrant it.

The flexible goals in reporting procedures add discipline to comprehensive energy policy that makes DOE and other responsible policy-implementing agencies accountable for their actions, but it avoids being prescriptive about which actions to undertake.

The President's energy strategy calls for, I quote, "Ensuring the availability of adequate energy at reasonable prices, protecting the environment, maintaining a strong economy, and reducing U.S. dependence on unreliable energy suppliers." In spirit, this collection of goals sounds very much like the overarching goals I recounted earlier, economic vitality, environmental quality, and national security.

Many of the recent debates about comprehensive energy policy have focused on much narrower issues. For example, as Mr. Saba noted earlier, the actions proposed in the NES instead of being gauged against targets aimed at fulfilling these goals are deeply tempered by the President's stated keystone of the strategy, namely reliance on market forces.

Some in Congress agree that the NES a priori market test is appropriate even though it excludes many options from consideration. Others feel that the result of a such a filter is a narrow set of supply options and an almost complete neglect of the demand-side measures except R&D.

Consequently, the debate centers on issues for which no analytical base is included. We feel that the NES's final set of actions could have emerged with a more balanced portfolio of supply and demand options had all options been evaluated and compared against each other in terms of their relative contribution to overall policy objectives.

Many of the details of the NES process are just appearing now in a series of technical annex documents being prepared by DOE. We and many others are studying the final portfolio of options included in the NES and the process that led to it.

As Congress considers the President's strategy and other legislative initiatives that may complement or replace the NES, a strategic framework with well-defined goals can help compare various proposed actions in a consistent, systematic way.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Blair follows:]

PREPARED STATEMENT OF DR. PETER D. BLAIR, PROGRAM MANAGER, ENERGY AND MATERIALS OFFICE OF TECHNOLOGY ASSESSMENT

Mr. Chairman and Members of the Committee: Thank you for the opportunity to testify today on the Nation's progress toward energy security and to discuss S. 1018, "The Energy Goals Act of 1991." As you know Mr. Chairman, OTA has appeared before this and other Committees of the Congress suggesting that a systematic, comprehensive energy policy would be well served by including a set of specific goals against which the contribution of proposed policy actions can be measured. In short, if we don't know where we are headed, we can't figure out how to get there.

Last fall we testified before this Committee that goals and establishing procedures for measuring progress in energy policy are particularly important now because the nature of energy policy concerns in the U.S. have evolved considerably in the almost two decades since the first Arab oil embargo in 1973.[1] Throughout the 1970s, concern about energy price and availability spurred development of a wide range of new energy supply and demand technologies. To a large extent, these technological developments were responsible for the present situation of ample, reasonably priced energy, by both increasing supply and reducing demand.

In the 1990s, energy policy concerns will focus less on price and availability, as in the 1970s, and more on factors such as regional and global environmental quality, the impact of oil imports on our balance of payments, international competitiveness, national security costs of imported oil supplies, and interactions with other social, economic, and environmental policies. While none of these factors can, at present, be conclusively proved to mandate major policy changes, long-term trends such as those in oil imports and in CO_2 emissions from fossil fuels are so alarming that it would be foolhardy to ignore them. In particular, a comprehensive, strategic national energy policy cannot be viewed merely as an end in and of itself. Just as energy is useful only insofar as it provides needed services, energy policy is a function of broader and more fundamental national goals, in particular economic vitality, environmental quality, and national security. Not viewing energy policy in this light was a serious flaw in much of the thinking of the 1970s and 1980s.

NATIONAL ENERGY POLICY GOALS AND OBJECTIVES

Congress is now considering the President's National Energy Strategy and a wide range of other energy-related legislative proposals. In evaluating the various options reflected in these proposals, it is important to weigh them in the context of the three overarching goals noted above. Some energy options support all three goals, particularly those that improve efficiency of production and use. Others can have conflicting results. For example, increased reliance on coal could cut oil import dependence, but exacerbate problems of air pollution and global climate change.

S. 1018 focuses on energy security goals and carbon emissions from energy sources. It suggests goals of reducing oil imports, increasing energy efficiency, and reducing the carbon intensity of the U.S. economy through accelerated development and use of renewable energy technologies.

Reducing Oil Import Vulnerability

U.S. dependence on oil imports is of increasing concern. In 1990 the bill for oil imports amounted to $65 billion, well over half of our total balance of payments deficit ($101 billion). Unless major steps are taken, that dependence will grow substantially. High levels of oil imports do not by themselves lead to poor trade balances (Japan is one counter example), but such a high cost warrants strenuous efforts to ensure that oil is used with optimal efficiency (see Figure 1). Furthermore, many of the costs of import dependence (e.g., environmental damage from oil spills and the military costs to protect oil supplies) are not reflected in the market price of petroleum products. Some of these costs, in particular military, apply disproportionally to the United States, relative to European countries and Japan, all of which have higher energy taxes. Improved energy efficiency, the development of fuels to replace oil, and the reflection of external costs in market prices, clearly are in the national interest. Whether policies to implement these changes are justified is a value judgment for policymakers.

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[1] Johhn H. Gibbons, "On Relieving U.S. Oil Dependence," Statement before the Senate Committee on Energy and Natural Resources, October 2, 1990.

A strategy to limit oil import dependence and vulnerability might involve goals to (1) limit overall oil imports, perhaps to 50% of total U.S. oil use, as proposed in S. 1018, and (2) diversity sources of world oil production and therefore U.S. sources of imports to regions of the world outside the Middle East where such imports can be aligned with other U.S. policy interests. Other than noting that the potential for improved production in the Soviet Union, Asia, and South America is great, I shall not address the latter goal in this testimony. OTA completed an assessment on the potential for increased production in the Soviet Union in 1981.[2]

The first goal of limiting imports could be met with a combination of supply and demand initiatives. The decline in domestic oil production can be slowed with new exploration and recovery technologies applied to existing fields and by opening up new areas for exploration. Developing and producing alternative transportation fuels would shift supplies away from oil. Demand mechanisms include improved efficiency of use in all sectors and shifting of industrial, residential and commercial oil use into other sources such as natural gas and electricity. For the next several decades, demand mechanisms can be considerably more important than supply, as shown on Figure 2.

Some options may lead to policy conflicts. For example, production of potential oil resources in the Arctic National Wildlife Refuge, or in sensitive offshore areas, raises serious environmental issues. Similarly, commercialization of technologies for producing alcohol fuels from grain would likely affect food prices and land use patterns. Sustained research and commercial development of new technologies may help resolve the conflicts.

S. 1018 proposes holding U.S. oil consumption to 33% of total energy use by 2010 and holding imports to 50% of total oil use. The former will be much less challenging than the latter. Electricity and natural gas are likely to replace many uses for oil over the next two decades, reducing oil's fraction of total energy use from 40% in 1990 to 37% by 2010. With no policy action, due to declining domestic production, most forecasters expect oil imports to rise substantially to nearly 65 percent of total oil use by 2010. The 50% imports goal is challenging indeed and would require substantial commitments from both supply and demand side options (Figure 2).

Energy Efficiency

Various studies over the past decade have consistently shown that energy efficiency is an essential cornerstone to a comprehensive energy policy framework. About two-thirds of the falling U.S. energy intensiveness (energy use per dollar of GNP) of the last decade is attributable to improved efficiency in energy conversion and use in every sector of the economy (see Figure 3). The other factor prominent in declining U.S. energy intensiveness over this period was the changing structure of the economy, e.g., the decline in energy intensive domestic industries (in many places replaced by energy intensive imports).[3] The efficiency gains—reductions in the energy consumed per unit of service provided (area heated, miles travelled, etc.)—have generally come about with net cost savings and without sacrifice of comfort or convenience.

Considerable future energy efficiency gains are still possible in all sectors of the economy using existing technology, and even greater cost savings and efficiency gains are possible with technologies under current R&D. For example, in OTA's recent report, *Energy Efficiency in the Federal Government: Government by Good Example*, we found that "commercially available, cost-effective measures including high efficiency lighting and carefully operated heating, ventilating, and air-conditioning (HVAC) systems could likely conserve at least 25 percent of the energy used in Federal buildings with no sacrifice to comfort or productivity."[4] An efficiency goal of sustained improvement of 20 percent per decade for the next two decades is ambitious but realistic for the United States. A combination of increased research on energy efficiency, increased investment in efficient equipment, and policy leadership can meet or exceed 20% improvement per decade at less cost than pursuing the supply-side path. Moreover, pursuing such a goal supports all three policy interests of economic vitality, environmental quality, and energy security. S. 1018's goal of 2 percent per year increase in energy efficiency coincides with OTA's candidate goal.

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[2] U.S. Congress, Office of Technology Assessment, *Technology and Soviet Energy Availability*, 1981.

[3] The changing energy structure of the U.S. economy is addressed in detail in OTA's 1990 Background Paper, *Energy Use in the U.S. Economy*.

[4] This is the first of a series of reports being prepared at OTA in the course of the on-going assessment, *U.S. Energy Efficiency: Past Trends and Future Opportunities*.

Renewable Energy Technology

With no policy action, renewable energy use as a percentage of total energy use is projected to rise from 8 percent currently to 10 percent by 2010.[5] S. 1018 proposes a 14% goal for 2010, which is a realistic challenge, perhaps even modest. This goal, coupled with accelerating use of natural gas, which many researchers view as a bridge fuel to biofuels or other alternatives, especially in electric power production and possibly transportation, could "prime the pump" of moving beyond the fossil fuel era. However, this goal will not be met unless it is established now because a long time is required in order to effect a major turnover of the capital stock of energy supply as well as consuming equipment. Short-term strategies—either to spur production or to curb consumption—are often inefficient and traumatic. A comprehensive energy policy must be responsive to sudden changes of events, but it also must be fundamentally grounded in long-term strategies and enforced even in periods when crises seem distant.

For decades most people have assumed that fossil fuels can supply human energy needs for several more centuries. The specter of global climate change as a result of carbon dioxide emissions may invalidate that assumption. The fossil era may need to end, not in centuries, but in a century or less. Nuclear power (fission and fusion) and renewables are the only energy sources that do not emit CO_2. At present, they supply only about 15% of our energy needs, but they may soon have to become globally dominant, perhaps within fifty years.

Compared with nuclear power, renewable energy technologies have attracted only modest investments in R&D from both public and private sources so far. Consequently, major innovations are not apt to come about soon for many of these technologies, compared with the likely incremental changes ahead for nuclear and fossil technologies. On the other hand, while comparative costs still favor fossil technologies, the costs are converging. The cost of renewables is now within a factor of two of that of fossil fuels, down dramatically within the last decade. Energy policy and environmental policy suggest that renewables as well as nuclear should be important options, but both will require substantial R&D before they are can play significant roles.

REPORTING TO CONGRESS

An important lesson from 1970s and 1980s is that energy goals are not very useful unless they are flexible, i.e., can be addressed by a variety of options and can be modified if warranted as circumstances change. S. 1018 provides for determining appropriate measures of energy efficiency, acquisition of the necessary data to gauge the level of energy efficiency by those measures, and the contingency for modifying energy objectives—for reduced oil consumption, increased energy efficiency, and commercial use of renewables—if changed circumstances warrant it. The flexible goals and reporting procedures established in S. 1018 add a discipline to comprehensive energy policy that makes DOE and other responsible policy implementing agencies accountable for their actions, but it avoids being prescriptive about which actions to undertake.

In the past Congress has attempted in legislation to prescribe, for example, very specific cost and performance characteristics for selected technologies ranging from wind turbines, to magnetic fusion, to advanced coal technologies. If specified cost and performance objectives are not (or cannot) be met, then the underlying policy goals may become irrelevant. Under broader, more flexible goals, the implementing agencies have many options and can be held responsible for pursuing alternatives if initial courses of action are not successful. In the areas identified by S. 1018, the proposed goals and objectives offer that flexibility while, at the same time, establish accountability for meeting or modifying the established objectives.

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[5] U.S. Department of Energy, *1990 Annual Energy Outlook: Long Term Projections*, Energy Information Administration, DOE/EIA/0383(90).

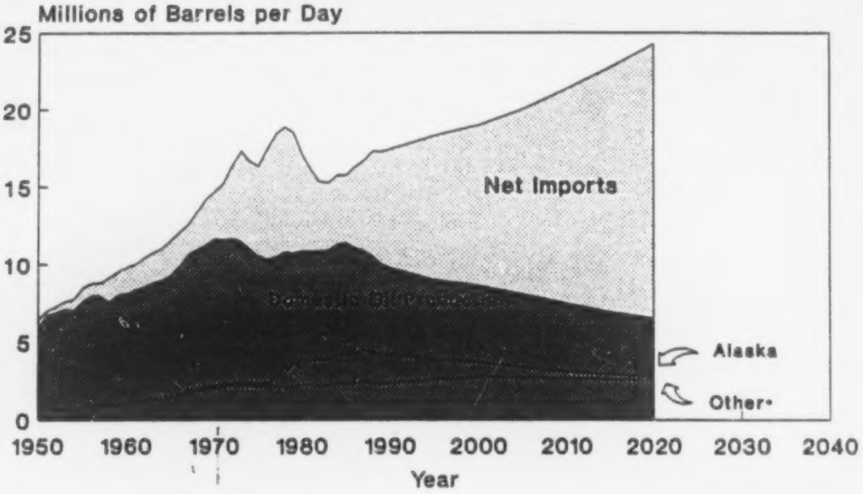
THE NATIONAL ENERGY STRATEGY

The President's energy strategy calls for "ensuring the availability of adequate energy at reasonable prices, protecting the environment, maintaining a strong economy, and reducing U.S. dependence on unreliable energy suppliers." In spirit this collection of goals sounds very much like the overarching goals I recounted earlier of economic vitality, environmental quality, and national security.

Many of the recent debates about comprehensive energy policy have focussed on much narrower issues. For example, the actions proposed in the NES instead of being gauged against targets aimed at fulfilling these goals, are deeply tempered by the President's stated "keystone of the strategy," namely reliance on market forces. Some in Congress agree that the NES a priori "market test" is appropriate, even though it excludes many options from consideration such as energy taxes or efficiency standards for autos or appliances. Others feel that the result of such a filter is a narrow set of supply options and an almost complete neglect of demand side measures except R&D, despite clear evidence that improved efficiency can be far more beneficial than supply measures for the next two decades. Consequently, the debates center on issues for which no analytical basis is included. The NES's final set of actions could have emerged with a much more balanced portfolio of supply and demand options had all options been evaluated and compared against each other in terms of their relative contribution to overall policy objectives. Many of the details of the NES analytical process are just now appearing in the series of Technical Annex documents being prepared by DOE. We and many others are studying the final portfolio of options included in the NES and the process that led to it. As Congress considers the President's strategy and other legislative initiatives that may complement or replace the NES, a strategic framework with well-defined goals can help compare various proposed actions in a consistent, systematic way.

Figure 1

U.S. Oil Supply and Demand Futures
Baseline Projection

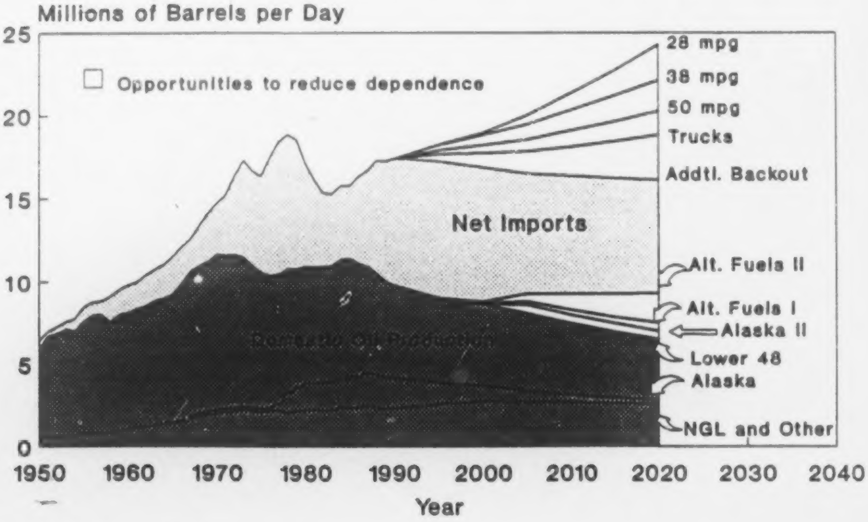


Office of Technology Assessment
Adapted from EIA, Annual Energy Outlook

*Natural gas liquids and other

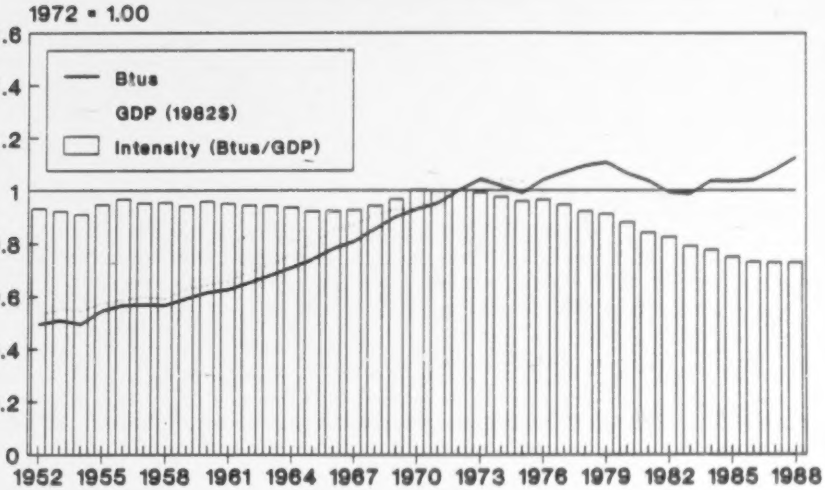
Figure 2

U.S. Oil Supply and Demand Futures
Improved Supply, Mileage, and Backout



Office of Technology Assessment

Figure 3
Index of U.S. Energy Use, GDP and Energy Intensity



NOTES TO FIGURES 1 AND 2

Figure 1: Baseline values for oil production from Alaska and the lower 48 were kept at the same level as in the EIA "Annual Energy Outlook 1990" (Base Case) for the period to 2010. The extension to 2020 was made by continuing the 2005 to 2010 trend projected by the EIA. Natural Gas Liquids (NGL) were similarly left at the EIA projected levels to 2010, and then extended to 2020 following the same trend as 2005 to 2010. The category "Other" was frozen at the EIA 1995 level of 0.8 MMBbl/day; levels in the EIA projection above 0.8 MMBbl/day were separated out under the category "Alternative Fuels I" and were added in separately in Figure 2.

Estimated oil demand began with EIA "Annual Energy Outlook 1990" Base Case levels (reaching 38 mpg for new cars and 24.4 mpg for new light trucks in 2010—the 38 in case) and were then adjusted to reflect a continuation of the current level for new cars of 28 mpg and for new light trucks of about 21 mpg—the 28 mpg case. This resulted in a change in weighted (cars and light trucks) fleet average mileage from EIA projected levels of 23.5 mpg (38 mpg case) in 2010 (on the road mileage is assumed to be 80% of that measured by a CAFE-type standard) to 20.5 mpg in 2000 (28 mpg case) which was then kept at this level till 2020. Corresponding annual percentage changes in mileage are 1.18% in the EIA projection (38 mpg case) carried through to 2020, and 1.0% in the 28 mpg case until 2000 and then left unchanged from 2000 to 2020.

Increasing light-duty vehicle efficiencies are counterbalanced, however, by EIA projections of an increase in Vehicle Miles Traveled (VMT) of 1.82% per year from 1988 levels through 2010. This was assumed to continue to increase at this rate through 2020. This is driven by such factors as population growth of 0.8%/year (246 million in 1988 to 307 million in 2025) and real GNP growth of 2.4% per year overall or about 1.6% per year per capita.

Figure 2: Three new sources of supply and three levels of transportation efficiency improvements are assumed to begin coming on line in the year 2000.

New Supplies: "Alternative Fuels I" assumes that fuels such as methanol, ethanol, etc. are added beginning in 2000 reaching 500,000 barrels per day by 2020, increasing at a capacity of 100,000 Bbls/day every five years. These estimates are derived from the EIA Base Case as described above.

"Alternative Fuels II" is the accelerated development case listed in the above white paper. This national laboratory estimate foresees alternative biomass derive fuels reaching 1.8 MMBbls/day more than in the base case by 2020 if additional RD&D funding is made available.

"Alaska II" assumes that a large new field is found in Alaska and an accelerated development effort is assumed to result in production levels rising to 500,000 Bbls/day by the year 2005.

Transportation Efficiency Improvements: The effect of three different transportation efficiency improvements is shown as "28 mpg", "38 mpg", "50 mpg", and "Trucks."

The case of 28 mpg for new cars and 21 mpg for new light trucks—continuing today's new vehicle efficiency levels for the next 30 years) and the EIA Base Case of 38 mpg for new cars and 24.4 mpg for new light trucks by 2010) were described above. The 50 mpg case assumes that both new cars and new light trucks have a weighted average fuel efficiency of 50 mpg combined, resulting in an average on the road total fleet fuel efficiency of 36 mpg by 2020 (allowing for turnover of the fleet stock and for the 20% reduction in actual on the road efficiencies from CAFE-type standards). The case "Trucks" assumes that half of the diesel fuel consumption (heavy trucks, buses, etc.) projected to be consumed by 2020 (EIA projection to 2010 extended at the same growth rate to 2020) could be backed out by 2020 through the use of compressed natural gas.

Backout assumes (in addition to 50 mpg and trucks) that one-half of the remaining non-transport uses of oil will be backed out in an aggressive conservation program—this is in addition to savings built into the EIA Base Case scenario. This results in a savings of 2.7 MMBbl/day by 2020, phased in linearly. The EIA Base Case Scenario already envisages annual residential and commercial consumption of oil decreasing at 2.6% and 1.8% respectively between 1990 and 2010 while population grows at 0.6% and total real GNP grows at 2.4% annually. Oil use in the utility and industrial sectors is assumed to increase at about 0.7% per year each, while electricity generation and manufacturing output are assumed to increase 3% and 2.8% respectively per year. Compared to current rates of energy use, this would suggest energy savings in the EIA Base Case of about one-half in the residential and commercial sectors, and one-third in the industrial and utility sectors from what it would have been in 2010 if energy use were to grow linearly with economic activity and/or population. The values shown in Figure 2 are thus an additional reduction of 50%.

Senator **Bingaman**. Thank you very much.

Mr. Chandler, why do you not go ahead, please.

STATEMENT OF WILLIAM U. CHANDLER, SENIOR SCIENTIST, BATTELLE MEMORIAL INSTITUTE, PACIFIC NORTHWEST LABORATORIES, ADVANCED INTERNATIONAL STUDIES UNIT

Mr. **Chandler**. Thank you.

Much of my written testimony echoes Peter Blair's excellent statement. And so I would like to focus now in this oral statement on three questions, the first being, is goal setting a useful exercise in energy policy making. And the second being, are the goals in S. 1018 reasonable ones? And third, what do the goals imply in terms of technology and policy?

First, do the goals themselves have value? S. 1018 focuses on energy efficiency, which in my opinion has been the best success story we have had in this country over the past two decades. We have saved money. We reduced oil imports. And we have saved carbon emissions with energy efficiency, a tool that has been more effective than anything else.

In fact, if you look at the record of carbon dioxide emissions in the United States, we have been able to virtually hold emissions constant over the past two decades while increasing economic output by 40 percent to 45 percent. Had we stayed on the old track of continuing energy and economic growth in tandem, we would now be emitted an extra amount of carbon dioxide equal to that of the entire country of China with about one-fifth of the world's people.

The role of efficiency in the future in reducing carbon dioxide emissions, for example, could also be vital. We, at Pacific Northwest Labs, have done some energy and economic modeling to address the questions of what might work to reduce future energy use, future emissions.

And we have done a couple of cases, one out to the year 2025, in which we make some fairly optimistic assumptions about population, holding population to something like 8 billion people worldwide, modest economic growth rates and so on. And we find that emissions would double from their current level by the end of the first quarter of the next century.

With implementation of energy efficiency policies to achieve a rate comparable to what you are proposing here, of about 2.5 percent per year worldwide, we estimate that emissions could be held roughly constant.

The question then becomes, of course, does goal-setting itself have value? Does it change behavior?

And throughout the economy indicators are essential to good policy making. We await eagerly monthly inflation statistics to evaluate our economic policy performance. We similarly wait for monthly unemployment statistics to assess whether we need to stimulate the economy or to change jobless benefits. So in effect, we use these indicators as a means of reviewing our performance so that we can make mid-course corrections in our policies.

Of course, goals are required to make these indicators meaningful. And S. 1018 does provide these goals. To this extent the legislation would, in effect, develop a kind of national report card on development of sustainable energy policies.

The second question is, are the goals reasonable? And there are several ways of addressing that. One is you can compare the goals to our past record of 2.5 percent energy improvement, as Peter mentioned, or I should say energy intensity reduction, two-thirds of which was energy efficiency improvement. And depending on how you interpret the goal in the bill, whether it is compounded or simple, the rate is either comparable to this record or slightly more ambitious.

If we compare it to expert studies done which set targets for energy efficiency improvement and the cost effective potential for energy efficiency, we find the goal is consistent. For example, there was a study done by the American Council for an Energy Efficiency Economy involving 30 experts who suggested a goal of 2.5 percent per year energy intensity reduction through the next two decades. S. 1018 would suggest about a 1.8 percent energy efficiency improvement rate on a comparable basis.

A recent national laboratory study, four Department of Energy National Laboratories looking at the cost effective potential for energy efficiency to the year 2010 suggested that this rate could lie in the range of 2 percent to 2.2 percent. So the question of, is this particular goal reasonable, is, yes, it does seem achievable, plausible.

With regard to the goal of achieving the goal of oil imports reduction, that is a little harder to assess because it depends on prices of fuels as well as the overall economic growth rate and so on. We, in this study I just mentioned with the four national laboratories, estimated that oil as a percent of total supply in our reference case without additional policies, would amount to about 36 percent. The total supply from oil would be about 36 percent.

In a policy case, we suggested that the share of energy coming from oil could be as low as 28 percent. With a goal of 33 percent for the year 2010 in S. 1018, again, you have a goal that is consistent with what these laboratories have found as plausible.

In terms of renewables, again this is a difficult area to make assessments. However if one takes estimates of, for example, the biomass potential in the United States, with rapid development of that resource you would, under the scenario laid out in S. 1018, you would in fact implement about half the potential for biomass estimated in the United States over that period.

What the legislation implies in terms of technology, the third question, suggests that the requirements would be strong and ambitious, but not overly stringent. What is implied, for example, would be 35 miles per gallon to 40 miles per gallon for automobile fuel economy beginning in the year 2010 would require virtually the same appliance of efficiency standards as are currently in effect or will be in effect over the next few years.

It will require better incentives for efficiency in utility planning. And probably will require additional policies such as taxes. Certainly, it will require more emphasis on research and development.

In conclusion, I would say that S. 1018 should improve the visibility of these issues by creating a kind of report card. It does set out reasonable goals. It should help foster attention to mid-course corrections. And having just come from China and Poland, where I have seen the mess that central planning can make, I have to say that what you seem to be suggesting here does not look very much like what I saw in China and in Eastern Europe.

[The prepared statement of Mr. Chandler follows:]

PREPARED STATEMENT OF WILLIAM U. CHANDLER, SENIOR SCIENTIST, BATTELLE MEMORIAL INSTITUTE, PACIFIC NORTHWEST LABORATORIES, ADVANCED INTERNATIONAL STUDIES UNIT

Thank you, Mr. Chairman, for the opportunity to comment on S. 1018, "The Energy Goals Act of 1991." The legislation correctly identifies the problems caused by weak energy policy: reduced economic competitiveness, compromised energy security, and diminished environmental quality. It sets goals for increasing energy efficiency, developing renewable energy, and reducing oil imports, and requires reports on progress toward these goals. My testimony will address the general question of the value of goal setting in national energy policy, the feasibility of the legislation's energy goals, and use of policy instruments in achieving the goals. These points are illustrated with reference to oil use.

DO GOALS HAVE VALUE

"The Energy Goals Act" would increase attention to indicators of progress toward sustainable energy and economic development. It would, in effect, create a national "report card" on progress in energy efficiency, renewable energy development, and oil dependence. Such indexes serve to illuminate where we are headed and to give early warning that a course correction is necessary.

Thoughtful goal-setting is essential for effective public policy. The nation does rely heavily on such indicators in other policy spheres. For example; we anxiously anticipate unemployment statistics because we want to know how we are progressing toward full employment. Economists await monthly statistics on inflation because controlling price increases is fundamental to sound economic management. The frequent publication of these indicators helps us to evaluate the health of our economy and to guide critical policy decisions—decisions ranging from adjustments to the money supply to changing jobless benefits.

The Department of Energy and the Energy Information Administration provide the basis for such measures of energy policy effectiveness through energy demand projection exercises and regular publications of energy data.[1] Both activities are invaluable to understanding our energy future and the problems it may hold. By setting real goals for energy policy, S.1018 would create a context against which demand projections and current trends can be evaluated. By increasing the visibility and relevance of energy policy performance indicators, S. 1018 would heighten public awareness and encourage policy corrections.

A danger does exist that goals can be set and enforced too rigidly. Energy policy works best when, for example, sufficient time is allotted for replacing capital equipment to meet higher energy efficiency requirements. Command and control economies are without exception the most energy inefficient on earth.[2] However, all market economies impose taxes and performance standards on energy use, and these can be adjusted in response to unsustainable trends. Changing circumstances—such as fluctuating prices—can change the course of energy use. By examining both current trends and future projections, we can ascertain whether the nation is likely to meet a given energy goal. Taxes and performance standards, for example, can be adjusted to set the nation on a better course of its own choosing.

DO S.1018'S GOALS MAKE SENSE

Does it make sense to target oil imports, energy intensity, and energy supply types for national policy? It is reasonable, in my opinion, to consider applying technologies and policies when energy waste threatens our economic, environmental, and human values. The threat to these values was evinced by the recent Gulf War, which confronted us with our third oil crisis in two decades. To our credit, the United States acted to reduce energy waste after both the Yom Kippur War in 1973 and the Iranian Revolution in 1979. We can do so again.

The best lesson we can take from the past two decades of energy policy experience is simple: Energy efficiency works. New cars now travel twice as far on a gallon of gasoline as did 1975 models. Industry in 1985 produced 45 percent more value per unit of energy than in 1970.[3] Buildings now use less than half as much oil as in 1973. The U.S. economy produces almost 50 percent more value per unit of oil and natural gas consumed than two decades ago. (See Figure 1.)

This improvement compares favorably with that achieved in other western nations. And although our country remains more energy-intensive than our competitors such as Germany and Japan, we are much less energy-intensive than the planned or formerly-planned economies.[4]

In the United States, however, we have much work to do. Oil still supplies about 40 percent of total American energy demand—16-17 million barrels of oil per day (about 35 quadrillion BTU per year). Oil imports are over a third higher than in 1975, and supply 45-50 percent of total oil consumption. Twelve percent of our oil today comes from the Persian Gulf countries.

The magnitude of our energy use can be seen in a simple comparison: The United States, with five percent of the world's population, now uses 25 percent of the world's current oil supply.[5] (See Figure 2.) While we produce 20 percent of the world's commercial goods and services, the scale of our oil consumption causes problems for the developing countries, and creates difficulties for us as we attempt to solve global environmental problems.

Energy Efficiency and Greenhouse Gas Emissions

S. 1018 targets anthropogenic carbon dioxide emissions as a threat to the global climate. No effort has reduced the growth of carbon emissions so dramatically as energy conservation; which permitted the United States virtually to hold emissions constant between 1973-88. U.S. carbon dioxide emissions (measured as carbon) reached 1.27 billion tons in 1973, and remained roughly at that level until 1988, when the total reached 1.31 billion tons. Unfortunately, soil energy prices and weak energy policy have recently combined to allow resurgent energy demand growth—and increasing greenhouse gas emissions.

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[1] See "Monthly Energy Review," for example, for regular measures of changes in energy intensity.

[2] William U. Chandler, Alexei Makarov, and Zhou Dadi, "Energy for the Soviet Union, Eastern Europe, and China," *Scientific American*, September 1990.

[3] Energy Information Administration, *Energy Conservation Indicators 1986 Annual Report*, February 1988.

[4] William U. Chandler, Alexei A. Makarov, and Zhou Dadi, "Energy for the Soviet Union, Eastern Europe, and China," *Scientific American*, September 1990.

[5] The British Petroleum Company, *BP Statistical Review of World Energy*, London, June 1990.

A simple policy experiment emphasizes the importance of energy efficiency goals for reducing the risk of climate change. Consider a world in which population grows moderately, reaching 8 billion by 2025. Assume that incomes grow at a moderate rate. And further assume that energy intensity declines at the historic rate of 1 percent per year. Finally, assume no major changes in the price of nonfossil energy sources. The result is troubling: fossil fuel carbon emissions double over the next three decades. In such a case, serious global warming will be inevitable. (See Figure 3.)

Consider this scenario again, but add to it a global 2.5 percent rate of energy efficiency improvement. The result would hold carbon emissions to just over 6 billion tons in the year 2020, compared to 11 billion in the base case. Efficiency alone would thus hold emissions almost constant, and hold carbon dioxide concentrations below 420 ppm through that year (compared to about 350 ppm today).

How do recent estimates of future efficiency potential compare with the goals set out by S. 1018? They are consistent. It is important to note that S. 1018 distinguishes between energy efficiency and energy intensity (that is, between energy used per unit of output without and with structural change in the economy, respectively). The legislation sets out an energy efficiency improvement rate of 2 percent per year.[6] While energy intensity was reduced between 1973-88 by 2.5 percent per year, only about two-thirds of this rate is due to technical energy-efficiency improvement; while the rest was due to structural change. About 2 percent per year could be considered unrelated to structural change.

The United States could probably afford to set and achieve a goal of reducing the energy intensity of its economy by 2.2-3.0 percent per year into the next century.[7] Indeed, it has been my own experience that when I have suggested setting goals of about 2.5 percent per year for energy intensity reduction in the United States, the strongest criticism comes from observers who believe that the goal is too modest. The energy efficiency goals of S. 1018 thus reflect both thoughtfulness and reasonableness.

Oil-Use Efficiency

The United States will on its current course probably miss the opportunity to save over 3.5 million barrels of oil per day (7.4 quadrillion BTU) in the year 2010.[8] Of this savings total, about 2 million barrels per day would come from transportation. (See Figures 4 and 5.) However, significant energy savings will not be captured without federal policy leadership. The need for policy appears to be particularly strong in the use of oil in the transportation sector.

The transportation sector is the key to future oil use, and automobile fuel economy is the key to transportation fuel efficiency. Average U.S. automobile fuel economy would reach only 26.6 MPG by 2010 if we continue "Where We Are Headed." However, if we instituted automobile fuel economy policy, the U.S. fleet (all cars in use) could reach 37.5 MPG at no extra cost to society. This estimate assumes a 7 percent real (above inflation) social discount rate for investments made in saving energy in the automobile, and that fuel economy would reach nearly 38 MPG. The additional energy savings from autos and light trucks alone would amount to about 1.2 million barrels of oil per day.

One potential concern for the oil-reduction goal is its possible conflict with the implicit goal of reducing greenhouse gas emissions. Because oil contains approximately 19.9 kilograms of carbon per gigajoule compared to 23.9 kilograms per gigajoule of coal, carbon dioxide emissions could increase if coal were replaced with coal.

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[6] It might be noted that energy efficiency improvement rates depend on whether they are compounded annually or as simple improvements from a baseline. If the latter, a 2 percent per year rate yields 10, 20, 30 and 40 percent improvement in 1995, 2000, 2005, and 2010, respectively, as stated in the legislation. If the former, a 2 percent rate yields a 9, 18, 26, and 33 percent reduction in energy intensity in the target years. The rates compared against the legislation's goals in this testimony are compound, not simple, rates.

[7] William U. Chandler, Howard S. Geller, and Marc R. Ledbetter, *Energy Efficiency: A New Agenda* (Washington: American Council for an Energy-Efficient Economy, 1988); Roger S. Carlsmith, William U. Chandler, James E. McMahon, and Danilo J. Santini, "Energy Efficiency: How Far Can We Go?," "National Laboratories Report to the National Energy Strategy," January 1990.

[8] Roger S. Carlsmith, William U. Chandler, James E. McMahon, and Danilo J. Santini, "Energy Efficiency: How Far Can We Go?, "National Laboratories Report to the National Energy Strategy," January 1990.

If the current market share of oil were reduced from 39 percent to 33 percent of U.S. energy—and replaced with coal—the net result would be less than a 10 million ton increase in carbon emissions (that is, an increase of about 0.7 percent of 1990 emissions). Other policies for reducing coal use would probably be helpful in offsetting any potential conflict with environmental goals.

Renewable Energy

Although many forms of renewable energy exist and it is difficult to evaluate S. 1018's goal for renewables, it is at least possible to consider its plausibility. We can illustrate the potential for biomass energy, which is perhaps more environmentally benign than other renewable energy forms such as hydroelectric power. Several studies have suggested that at least 12 exajoules (about 12 quads) of biomass could be added to U.S. energy supplies by 2020. Compared to the 8 EJ level of renewables currently in use, this would permit a renewable energy supply growth rate of about 3.1 percent per year. By comparison, S. 1018 would require only a 1.8 percent rate of increase in renewable energy use measured against current renewable energy supply.

The development of biomass energy potential and other renewables will naturally depend on the price of conventional energy sources as well as the development of new technologies. Recent research on biomass energy suggests that new technical systems such as integrated gasification of biomass for use in combined cycle gas turbines or even in fuel cells would provide cost-effective, plentiful sources of renewable energy. This prospect is attractive, because many renewable energy designs remain expensive compared to the fossil fuels.[9]

REPORTING REQUIREMENTS

The Energy Goals Act would emphasize progress in achieving energy efficiency improvement, oil imports savings, and carbon emissions reduction by requiring reports to Congress on progress towards the goals of S. 1018. Such reports might be most useful if the indices were prepared for the public at large and on a more frequent schedule.

For example, reporting requirements could be such that easily understood indicators would be presented to the press and the public on a monthly basis. Because so many Americans are deeply concerned about environmental issues, monthly reporting on progress towards environmental—not to mention economic—sustainability would probably be well-received. By calling attention to progress or lack of progress in critical indexes of international competitiveness, energy security, and environmental protection, the nation would thus be regularly informed on how well our government is managing our vital interests.

Energy Efficiency Improvement Rates

Source	Year of goal	Improvement rate (percent)	Efficiency improvement (percent)
National Labs Study [1]	2010	2.2	N/A
ACEEE	2010	2.50	N/A
S. 1018 [2]	1995	2.1	9.4
	2000	2.11	18.0
	2005	2.38	25.7
	2010	2.55	32.7

[1] Carlsmith, et al.

[2] Chandler, Geller, and Ledbetter.

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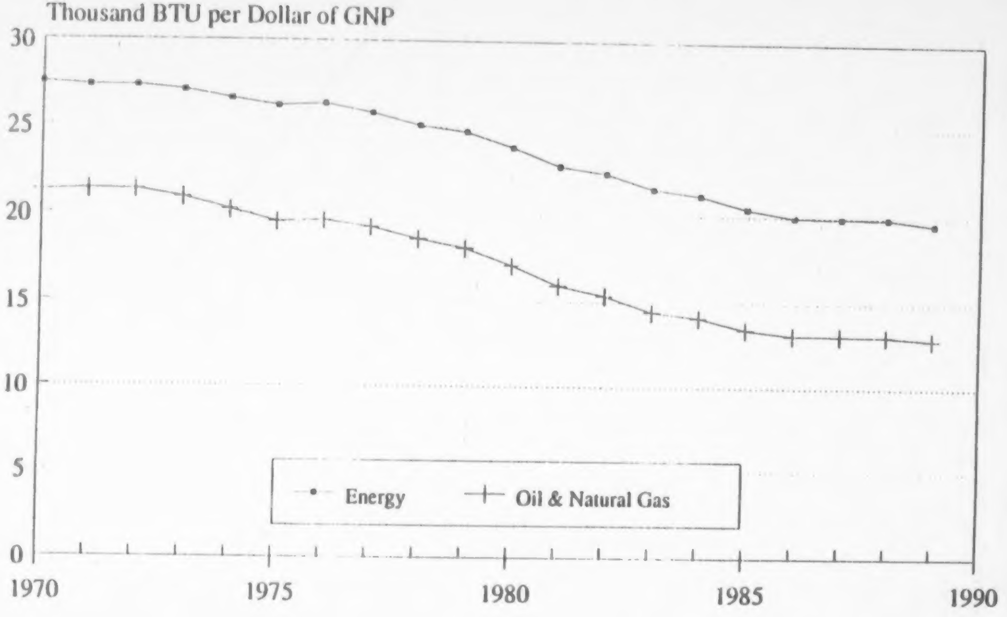
[9] Carl J. Weinberg and Robert H. Williams, "Energy from the Sun," *Scientific American*, September 1990.

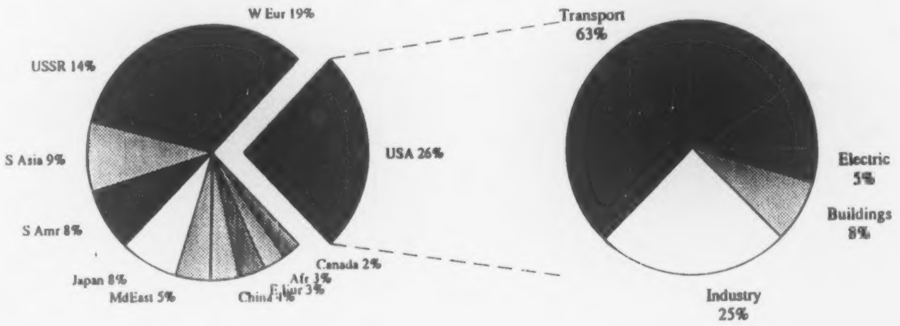
Figure 1

Energy Intensity of the
U.S. Economy, 1970-1989



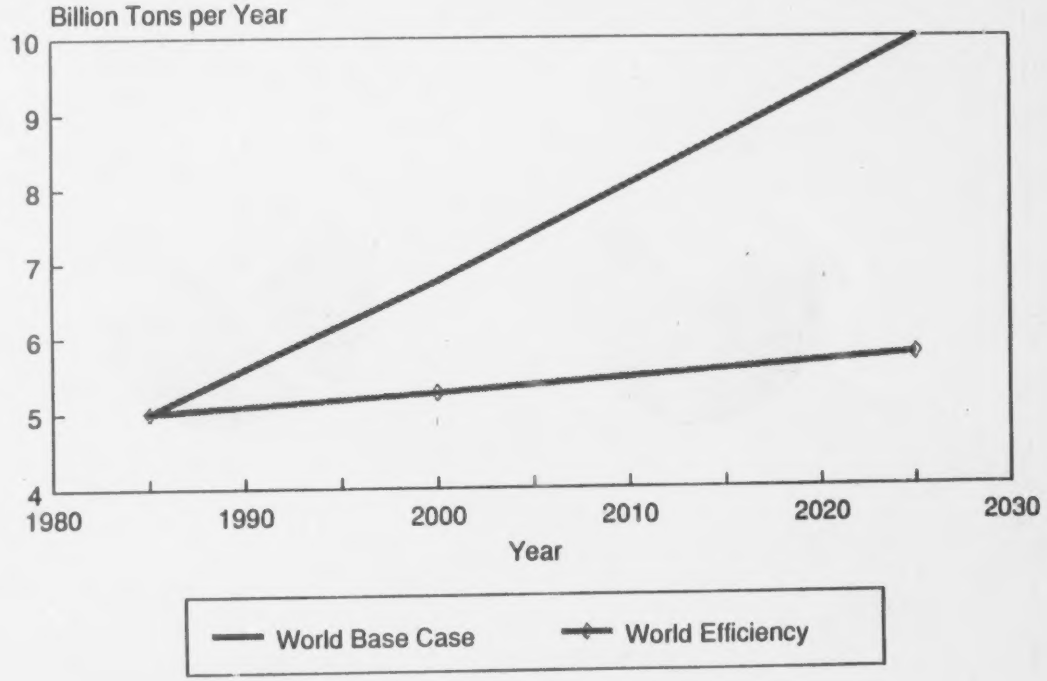
SOURCE:
Energy Information Administration

Figure 2
U.S. Share of World Oil Consumption



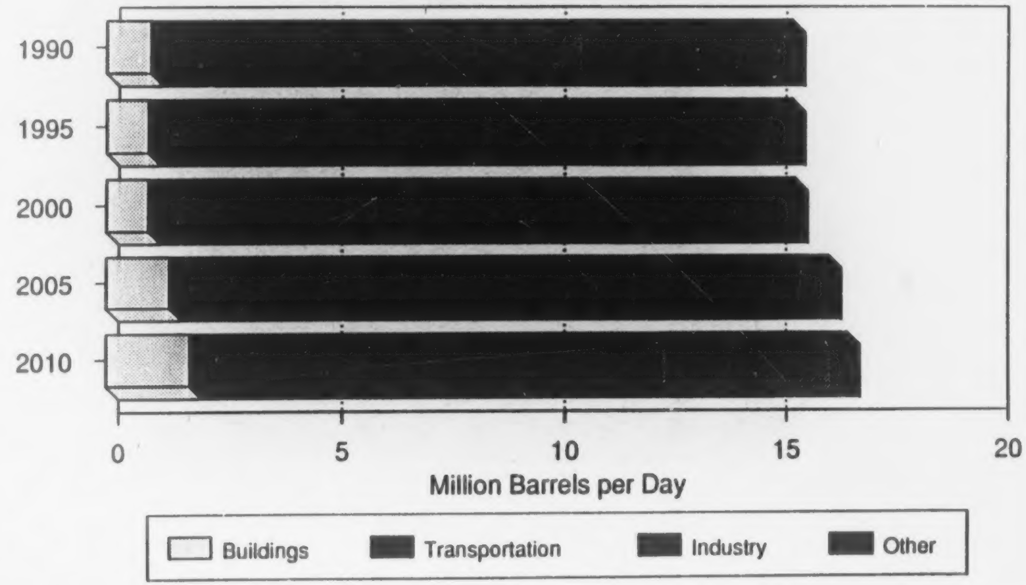
SOURCE: EIA;
BP Statistical Review of World Energy
[illegible]-03

Figure 3:
Global Carbon Emissions Scenarios



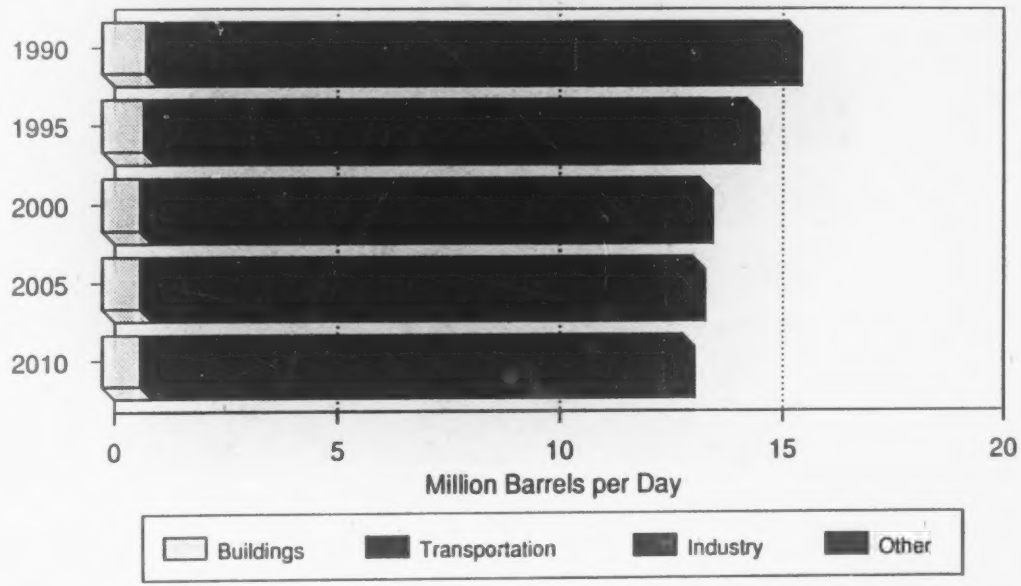
Source: W. Chandler, CLIMATIC CHANGE

Figure 4
"Where We Are Headed": Oil Use
by Sector, 1990-2010



SOURCE: Carlsmith, Chandler, McMahon, and Santini
test-15

Figure 5
"Cost-Effective Efficiency": Oil Use
by Sector, 1990-2010



SOURCE: Carlsmith, Chandler, McMahon, and Santini
[illegible] 16

Senator **Bingaman**. I appreciate hearing that.

Dr. Blair, have you folks done an estimate or projection as to how we would do on these various indicators in reduced oil consumption, increased energy efficiency or increased utilization of renewable energy under S. 1220?

Dr. **Blair**. We have not yet done that. We received the other day from some of the committee staff the submission from the Department of Energy and from several others places, and we are now reviewing them. We have not completed that analysis yet. We are anxious to try to do it to the extent that we can.

Senator **Bingaman**. We had some testimony from Mr. Saba, and I guess the Department of Energy, when they issued their National Energy Strategy, had these estimates for what would happen by the year 2010. They said that if we adopt the National Energy Strategy, they estimate that we would reduce oil imports from 65 percent to somewhere between 40 and 45 percent. Is that consistent with your own analysis?

Dr. **Blair**. We actually think that 40 to 45 percent is more ambitious than we came up with in our scenario that is illustrated in figure 2, which hits at roughly 50 percent.

An aggressive alternative fuels program, increased domestic production, and a very aggressive improvement in fuel economy or a reduction in fuel use in automobiles could result in a 50 percent import dependence. But 45 was very ambitious to us.

Senator **Bingaman**. That figure 2 that you say would get us down to somewhere around 50 percent, or keep us down around 50 percent for oil imports, that assumes a lot of things that are not in S. 1220 and things which were not in the National Energy Strategy either, as I understand it.

Dr. **Blair**. Indeed.

Senator **Bingaman**. In fact, most—not all, perhaps—of what might be done to reduce demand in your figure 2 is not included in either S. 1220 or the National Energy Strategy.

Dr. **Blair**. That is right. Part of the difficulty in comparing our projection with the NES base case projection and the strategy has to do with the details of the base case. That is, assumptions in the case of automobile fuel consumption and vehicle miles traveled and in the assumed fuel economy improvements that will occur without any policy actions, all of those items we are trying to sort through now to figure out what the differences are.

But the bottom line is that our estimates of what many things would happen on the demand side are somewhat different than those of the NES.

Senator **Bingaman**. I also have seen a projection here that relates to S. 1220 which says that energy efficiency measures in title VI are projected to reduced primary energy consumption in the range of .7 to 1.1 quads by the year 2000.

That is not a lot, is it? That is what, about 1 percent?

Dr. **Blair**. It is a small amount, I suppose. But more than that, we are having some difficulty figuring out how to assign what actions lead to that reduction. That is our current difficulty, and we are hopeful that as these technical annex documents come out, we will learn more about how they got to that number.

Senator **Bingaman**. But if that is anywhere near right, then I guess the energy efficiency goals that I have put in here, in this S. 1018, cannot be achieved, given enactment of S. 1220. Is that a fair conclusion?

Dr. **Blair**. It sounds right. I cannot react immediately, but it sounds very difficult, yes.

Senator Bingaman. Okay. Mr. Chandler, do you folks have any plans to do any projections for how we will be doing on some of these indicators, either under the National Energy Strategy or under the pending legislation, S. 1220, or anything else that is on the horizon?

Have you done that? I did not understand from your testimony the extent to which you have actually looked at the figures that you think are likely to be achieved under these different options.

Dr. **Chandler**. We did something slightly different. We asked the question, if you wanted to go as far as you could in energy efficiency, cost effectively, what would you do? How far could you go? We did not assess the policies that you describe per se.

Senator **Bingaman**. I will just comment here to get any reaction you would have on this. I would think it would be very useful to the committee and very useful to the Senate to see if there is a basic disagreement between OTA and the Department of Energy on where we are headed under some of these different scenarios, particularly the legislation that is going to be considered by the Senate on the floor here in another month or two.

I think there may be many people on the Senate floor who assume if we adopt that bill we are going to reduce our imports to 40, 45 percent. From all I have heard, that is no where in the cards, according to the projections you have done at OTA.

Dr. **Chandler**. We have not figured out exactly how the actions they propose map to the results that they project, and that is exactly what we are working on at the moment.

I might add that Mr. Murkowski referred earlier to the glass being either half full or half empty. I think what you are proposing here is to simply put a ruler inside the glass.

Senator Bingaman. Yes. I am just trying to get something that we could all sort of talk from the same script for a little bit and say, okay, this is where we are, this is what we have agreed to do, and we all agree that this is likely to be the result.

Then in 2 years or a year, we could look at it again and say whether it is not working. I think your comment that we are looking at something like a report card on energy is accurate. One of our big problems in energy policy has been that we do not seem to be able to sustain any public interest in the subject. It is not very clear that we can sustain a whole lot of governmental interest in the subject either.

Maybe something like this that required a regular review of where we are relative to where we thought we would be might help us to keep our mind on the subject.

Dr. **Chandler**. I have to confess that I have my name on several books that have in the title "progress toward sustainable development," and I do not know quite what that term means. But I do know that of the measures or indexes that you can develop for sustainable development, there are few that are as important as energy intensity or energy efficiency.

So measuring that on a regular basis, generating interest in that measure, and making corrections on the basis of how we are doing in that measure I think could be very valuable.

Senator BINGAMAN. All right. I appreciate you both testifying very much. I will ask the final two witnesses to please come forward, Mr. Melvin Conant and Mr. Ronald Morse.

Mr. Conant, you go right ahead, please. Thank you for being here.

STATEMENT OF MELVIN A. CONANT, PRESIDENT, CONANT AND ASSOCIATES, LTD., EDITOR, GEOPOLITICS OF ENERGY

Mr. CONANT. Thank you, Mr. Chairman. An introductory note, I was utterly baffled by the first exchange.

Senator BINGAMAN. By the first exchange?

Mr. CONANT. Yes. By you and the Department of Energy.

Senator BINGAMAN. Were you baffled by my side of it or by the administration's side?

Mr. CONANT. The administration's side.

Senator BINGAMAN. Okay.

Mr. CONANT. I have been in the private sector for many years. I have worked in Government here and abroad, and I just cannot for the life of me imagine how a great enterprise can move without targets.

Senator BINGAMAN. You might want to pull that microphone a little closer so people in the back can hear.

Mr. CONANT. Mr. Chairman, I welcome this opportunity particularly to comment in support of the notion that we should have an energy report card or what I have described previously as a national energy audit—a periodic review of how far we are moving towards we wanted to achieve, and with that, some considerations as to what additional measures might be needed from the Congress to facilitate our progress or correct our failings.

Now this has been a subject of great importance to me because of the different backgrounds in which I have lived. My specific assignment, Mr. Chairman, was to talk about the European scene and the extent to which the leading countries of Europe have in a formal way adopted energy policies which improve upon their economic and political security.

I think here we are talking about quite different societies, quite different processes, of government. There is no question in my mind that Great Britain, France, Italy, and Germany have all in their various ways pursued rather rigorously policies which they defined as affecting their economic progress and their security.

There have been several common elements in these policies. Some of them, with the exception of France, have been pursued through the International Energy Agency, especially the emergency stockpiling measures and demand restraints which could be deployed in case of need.

But we have had several other quite interesting examples of a steadfast commitment to a particular energy policy, which I think is worth noting.

The first of these I suggest is that of France, which some 16 years ago decided the time had come when it would no longer be dependent upon oil supplies from the Gulf and that they had in the nuclear option an opportunity to obtain the kind of energy security that no other energy source would provide them.

They have now been able to provide themselves with 75 percent of their electricity power demand through the nuclear option. They and the Japanese and, increasingly the Koreans, are the only ones who have made that kind of commitment as a deliberate target which they would bend every conceivable effort to reach.

In the case of the British, their situation changed rather dramatically with the North Sea. But up until then, their energy targets were defined very largely in a peculiarly British manner through their relationship with Royal Dutch Oil and British Petroleum. The fact that there were targets was never denied. And these were measurable over time.

In the case of Italy, if you will pardon an irreverence, there is a kind of special quality to the way in which the Italians go about their government and public affairs. They have moved in one direction or another; first of the nuclear option, then for greater coal, trying to back out oil, upon which it is dependent—95 percent on North African or Middle East sources, and they have not quite settled down. I think one of the reasons for this is that they have no agreed system for defining targets. It is more an opportunistic kind of policy.

In the case of the Germans, I think it has been another quite different process, one in which over the years I have followed with as much care as I can. It is a not a free enterprise system—a model of that—as the last president and previous administration described it.

It is a very effective, rather closely held confidential relationship between the government and the private sector in which it is understood quite clearly what it is that is expected to happen. In the case, for example, of replacing or substituting something for oil, they have pushed aggressively for the natural gas option, even when in our minds it went too far with gas supplied from the Soviet Union.

Nonetheless, this was a target; it was understood to be one. The instruments were available to put it into effect. Everywhere I looked were these principal energy consumers. There have been policies; there have been targets, and there have been private measurements of progress, nothing like what you are recommending and which I would support. But that has to with the differences in our way of governmental processes.

One possible exception to what I have said comes in the periodic reviews of the International Energy Agency. I was in on the early negotiations for that agency, and I can only say that the introduction of an idea of periodic energy reviews was something that the U.S. took as probably the least possible price for acquiring the support of our allies. It is not that we attached any importance to it at all.

We ourselves have been subjected to a periodic review by the IEA. It has usually been a somewhat polite exercise—more useful perhaps with other countries, such as Greece. But it has always been an informal, advisory function of the IEA. No one is required to do anything as a result of the review. So for those who might advance the example of the IEA as something akin to what you are suggesting, it is not. What you have in mind is something quite different.

I have not covered all of the points, Mr. Chairman, in my paper. I tried to summarize them as quickly as I can. I think I would just make one final observation.

Europeans look on the security question of oil imports quite differently from the way we do. They have lived with very large dependence on North Africa and the Middle East supplies for a great many years. They believe that their chosen course of action with regard to security is probably more effective than our own.

They believe, for example, that you should not be too much involved in what are Middle Eastern quarrels. Do not get immersed in the details of any issue, including the Arab-Israeli, lest one of these issues provoke a supply crisis.

It is a distance that they try to keep between them and their supplier in the Middle East. I think probably Mr. Morse might agree that that has been one of the Japanese's sort of principles.

So they look upon oil security—and I hope I am not exaggerating this—their oil security is being contingent to a great extent on what we do in the Middle East, believing that if we trip in the Middle East, they will certainly be affected. But they really do not want to be involved.

When I was asked to talk about the Europeans' and the Americans' views, this difference in concept is, I think, very important.

May I mention a word about your targets?

Senator BINGAMAN. Certainly.

Mr. CONANT. As I have heard the discussion this afternoon, I heard no reason why I would find any cause to disagree with your target, which does not mean that I would not agree with other definitions that came along. But the importance of having a target is inescapable. Without it you drift. And reliance upon the market forces is, in my view, a washout.

As I said, I worked in the oil industry for many years, and I think I would probably agree with somebody who would say there has never been a free market in oil.

Thank you.

[The prepared statement of Mr. Conant follows.]

PREPARED STATEMENT OF MELVIN A. CONANT, PRESIDENT, CONANT AND ASSOCIATES, LTD., EDITOR, GEOPOLITICS OF ENERGY

Mr. Chairman, I welcome this opportunity to testify in behalf of Senator Bingaman's bill (S. 1018) creating a process whereby the government and citizens will learn of the progress our country is making towards the fulfillment of specified energy goals. If we are failing to meet them, we would learn why and will then have an early opportunity to rectify the situation. Both as a government official and later as an energy analyst in private life, I have repeatedly asked that our country adopt such a review as the only measure we can have as to the nation's fulfillment of its objectives. If there are other opportunities in which I can help further this cause, Senator Bingaman has only to ask.

Mr. Chairman, I have been asked to help inform the Committee on Energy and Natural Resources of the energy policies and programs of European states. I have chosen to remark on key energy issues of France, Germany, Italy and the United Kingdom. The object is of more than academic interest for the subcontinent of

Europe, taken as a whole, is the second largest consumer of oil and the third largest consuming region of natural gas.

The nations of that subcontinent are also, collectively, the largest importers of oil and of internationally-traded natural gas. On the nuclear option, European countries, on an average, meet about one quarter of their electricity from nuclear facilities, with France meeting some 75 percent of its needs and Belgium about 60 percent from that source.

Furthermore, as the states of the Common Market move towards a single energy community, we are watching a dismantling of subsidies and other preferential acts, which have prevented member states from competing among themselves for least expensive supplies. Harmonization of energy taxes is an important objective. An end to German subsidization of domestic coal is one leading example. Reduction of barriers preventing other member-states from taking advantage of surplus French nuclear power generating capacity, and other measures which limit choice, is another. We are watching also moves toward a break up of the natural gas logistic system in which the concept of "common carrier" is gradually being adopted. More recently, the proposed European Energy Charter (the original initiative of Mr. Lubbers, Prime Minister of The Netherlands) aims at formulating investment guidelines to facilitate European investments in Eastern Europe and the Soviet Union. (The United States and Japan will be invited to participate.) We find in Europe the same motivations to surmount national barriers which frustrate energy trades that we also see in North American moves towards free trade generally, including energy flows.

Europeans and Japanese were also founders with the United States of the International Energy Agency whose original purpose was to create a number of strategic oil reserves and common emergency measures to cope with supply crises.

But there are differences between Europeans and Japanese and Americans on the energy outlook and the degree of risks run through dependence on oil imports especially from the Middle East.

Generally, Europeans have had to live with imports whose sources may be politically risky—a situation which they find quite normal, in contrast to our own historic concerns. Having had to live with high degrees of import dependence, they are more inclined to think of political diplomacy and non-interventionist policies to lower risks to supply than we are, or so the Europeans believe. To be more precise, a number of European energy specialists are ready to argue that the risk of an oil embargo against them is in direct proportion to the extent that U.S.-supported Israel is involved in another Arab confrontation. The European (and Japanese) belief is in accepting the Middle East as a political minefield and the greater the political distance between them and the region the greater is the likelihood their oil supplies will be relatively untouched. In the latest war the European and Japanese preference would have been to let Arabs sort themselves out. Oil supplies are never at risk for long; oil has always to be sold. It was the massive U.S. reaction to the invasion of Kuwait and to the clear threat to Saudi oil fields that caused the Europeans to join in the limited extent that they did (Britain and France excepted).

If this gives a sense of the general European approach to oil, what specific national energy policies and programs should be identified?

(1) The growing national interest in an ever-greater use of natural gas for environmental reasons and as an alternative to oil imports from the Middle East, and from North Africa. Everywhere in Europe one sees the attraction of natural gas. It has not required a mandated use of gas to account for its increased use; it has grown with the ever-larger sources of natural gas from Norway, the Netherlands itself, from North Africa and probably from Iran (piped into Central Europe) and later from Qatar and then, of course, from the immense reserves of the Soviet Union. The anticipation of natural gas has grown in direct proportion to the burgeoning strength of the environmental movement.

(2) The nuclear option needs to be mentioned. Everywhere in Europe—with the exceptions of Belgium and France—there is a faltering pursuit of nuclear power for assorted reasons. I have referred to the deep concerns over the safety of design and operations of Soviet-installed reactors. There is also the widespread public apprehension of the consequences of the Chernobyl disaster. In Italy, the nuclear option was stalled for reasons of public concern and of costs, as it was in Sweden (which has now returned, tentatively, to the continuing use of its nuclear plants); German opposition is based also on the design, construction and operation, and disposal of nuclear wastes, which is everywhere perceived to be an insoluble problem. In the case of Britain, whose nuclear commitment was long ago challenged by popular opposition, the country is now reeling under the blows of government's failure to be able to include nuclear plants in its power generation privatization program. The

disclosure that government has concealed the sorry record of its nuclear efforts at next-generation reactors and the revelation of the staggering costs of generating electricity from their nuclear plants is now said to have almost precluded taking more advantage of the nuclear option.

France is the country which some sixteen years ago, after the first oil embargo and large oil price hikes, decided to move on the nuclear option and free itself from the threats to oil supplies by becoming independent of Middle East sources. France saw in the nuclear option the opportunity to gain energy independence. The country has now come close to achieving that goal; seventy-five percent of its electricity is obtained through nuclear reactors. In recent years, France has become an exporter of electric power from having overestimated domestic demand growth rates for electricity.

(3) In the oil option, Europe has had two objectives:

(a) where oil reserves are found, exploit them to the fullest, notably in the North Sea where the British and Norwegians are dominant but also where many government and private sector oil companies invest. The North Sea is far and away the largest "European" oil resource.

(b) in reducing the rate of growth in energy-demand generally and for oil in particular through programs emphasizing greater energy efficiencies and the use of alternative fuels, despite continuing growth in GDP:

GDP and Primary Energy (1980-1989)

	GDP increase over decade (%)	Total primary energy (1989)[1]	Changes since 1980 (%)
France	2.1	219	−15.0
Germany	1.8	272	−.5
Italy	2.5	153	−10.3
U.K	2.3	211	−5.0

Percentage changes in fuels (1980-1989)

	Oil	Gas	Nuclear	Coal
France	−19	+13	+400	−37
Germany	−17	+6	+242	−11
Italy	−3.5	+63	−100	+18
U.K	−1.0	+13.5	+94	−7

	Energy Intensity (1989)[2]	Change (1980-1989)
France	-	-
Germany	0.39	−15.6
Italy	0.32	−10.3
U.K	0.41	−16.6

	Population Growth Rate (1980-1989)
France	.7
Germany	.7
Italy	.3
U.K	.3

[1] MMTOE = Million tons of oil equivalent.

[2] Total primary energy (MMTOE) divided by GDP (constant prices 1985 US$).

(4) Environmental Policies and Controls. Recognition of West Europe's pollution became a major issue in the mid 1980s. Effects of the public concern have not yet been captured in energy choices and data. Coal-burning pollution and auto emissions are long-standing issues but the full impact of the publics' awareness of pollution (everywhere) is not easily measured. Certainly, that awareness has been greatly heightened with the revelations of how badly polluted Eastern European countries have been. For West Europeans, conditions to their East are now the number one environmental fright, on the assumption that West European countries have already begun to tackle their own emergency.

(5) Government Intervention and the Private Sector. The most notable advance in British privatization has taken place in oil. Coal remains a government monopoly with major steps toward the privatization of natural gas. British Gas is a large

factor in the UK gas market in terms of supply and price, and further steps will surely be taken to reduce its now private monopoly role. In the case of France, there seems to be no large change in the role of government in affecting energy prices generally. The role of French oil companies is expanding rapidly, becoming competitive with large foreign oil interests. Italy remains the more deeply involved in product pricing (an aspect of the oil business which long ago reduced the interest of foreign oil companies in business in Italy. Since Italy imports nearly 80 percent of its energy requirements (and 95 percent of its oil needs), it seems to analysts that greater efforts at privatization may be desirable.

As the EC moves towards its January 1, 1993 deadline for major steps towards its maturity, German coal protection, Italian pricing and domestic protection seem to be the major barriers yet to be dismantled for the freer movement of energy.

It will be necessary for the EC and its key energy members to define soon the extent to which downstream investments by producing countries—especially those of the Gulf—will be welcome, on what scale and terms. In the past several years such investments have raised questions of control when the owners of these companies have been Middle East governments, not private sector oil companies.

It will also be important for the EC and its energy-important members to decide the extent to which a "dialogue" with producing states should be encouraged, and with what objectives. Of these member-nations, France and Italy have been the more interested, the United Kingdom least so. If the United States continues to refuse to participate on the grounds that the real objective of a "dialogue" is certainly to discuss oil prices and thereby become a new and larger producer-importer cartel, there could be another oil bloc formed from which we exclude ourselves.

Finally it is my understanding that in no West European country is there a periodic public review of energy progress/failings now proposed for the United States by Senator Bingaman. If we were to adopt such a process, I believe it would set an excellent example. As for others, our concept of a required government accountability to the public in the form proposed is still unfamiliar, with the exception of Great Britain.

Senator BINGAMAN. Thank you very much for your testimony.

Mr. Morse, thank you for being here.

STATEMENT OF RONALD MORSE, EXECUTIVE VICE PRESIDENT, ECONOMIC STRATEGY INSTITUTE

Mr. MORSE. As a private citizen, a red-blooded American, I find it increasingly depressing to constantly in this country be telling people that there is a country in the world that can do the things we say we cannot do.

We say we cannot educate people. The Japanese educate people. We say we cannot have a technology policy. They have a technology policy. We say we cannot set energy goals and we cannot do anything about reducing our dependency. They do it.

It becomes increasingly obvious that there is a lack of will in leadership across the board in this country, and as I point out in my written statement, there is a process by which all of these things can done. There is no magic to it. It just takes a concept of what should be done.

Let me just raise a few points in addition. I just came from Billings, Montana. Billings, Montana. is a city that is suffering because of fluctuations in oil prices. Beverly Hills High School has lost half of its revenue because they rely on oil wells. If you go to Texas, people are out of jobs because wildcatters, pipe companies, cannot drill oil.

If you look at retired people that suffered during the price gouging that took place in the last energy crisis, I think that the American people do not believe that the marketplace is a fair and equitable way to manage the American economy.

The second point. The Japanese have a saying that too many captains make the ship go up the mountain. My feeling is that there are too many admirals, retired admirals, in the Department of Energy who know a lot about strategy, but not very much about economics.

If you look at the way the Japanese political system works and the way our political system works, there is a big difference. In Japan, government has the responsibility to lookout for the welfare of the citizens. Their senior officials are career officials who try to bring the private sector, as I explain in my testimony, into line with goals that the government is responsible for.

The fellow from the Department of Energy implied that we cannot hold the U.S. Government accountable. If American taxpayers cannot hold the U.S. Government accountable to set goals, then the question is who can?

Political appointees in our system that come in, that have certain values, are bringing business values into Government and then applying them to the Government process. This is the wrong way around, in my view. And the reason why the Japanese are more effective is that the government seems to have a feeling that they are responsible for looking out for the welfare of everybody in the country in creating jobs.

Let me give you one example of how this works. Let me say in addition that if you compare the Japanese economy over the last decade and compare ours, the Japanese have had real income wage increases, while we have not. The Japanese have sustained growth, while we have not. The Japanese have sustained growth, while we have not. The Japanese have had success in penetrating the U.S. market, while we went into a deficit.

And the Japanese have had a very successful—as that chart over there will indicate to you, and it is in the back of the testimony—the Japanese have had a very successful record in rising growth, reducing oil dependency, and reducing the total amount of energy produced, reused, within the country.

Some people would say well, that is fine but we are interested in this country in protecting jobs. Well, let me make one argument which I think holds. Our energy policy is responsible for the fact that we do not have today an auto industry that can employ people.

Japanese, as you will see in the back of my testimony, charge people about 3—as to most countries—about $3 or so a gallon for gasoline. The second oil crisis hit in Japan, the Japanese produced energy-efficient automobiles. In this country, we did not respond to the market with high-energy prices. The auto industry did not respond with energy-efficient cars, and when the second oil crisis hit this country, the only people in the world that were producing energy-efficient automobiles were the Japanese. That is how that got into the auto market in the United States, because of our energy policy, in my view.

Finally, the Japanese believe in implementation. It takes money to do the things that you are suggesting, which are very important. It takes taxes and taxes are the way that the Japanese have responded. The Japanese believe that productivity, a growth economy, and a successful overall rising wage level for the Nation as a whole is attainable by taking some money out of the pockets of consumers to finance energy efficiency.

You have to raise prices, finance development, encourage domestic drilling. In fact I would argue that if the prices were higher in this country, it would probably overall create more jobs, because all of those people that are out of work as a result of the cheap Middle East oil prices would be put back to work in this country. And if you multiply the effect through the economy of real jobs for these people in our economy, it would probably contribute tremendously to the overall productivity of our economy, even though it may take some money out of people's pockets.

Finally, one last point. What is the price of oil in this country or what is the price of a gallon of gasoline? If you really begin to calculate the price of a gallon of gasoline, Americans probably pay about $8 to $10 for a gallon of gasoline because it includes the price of crude oil, refining, modest taxes, the defense of the Middle East, and one can throw in Desert Storm. Because this all comes out of the American people's pockets.

So it seems to me that if we want to have a comprehensive way of dealing with these issues, we have to look at it in economic terms. We have to do as you suggest, have goals. And it is very simple to do that. The Japanese produce these goals by the tons—21st century vision, energy vision. They consult with people at all levels. They talk to industry. They arrive at these goals. They set them on the basis that they are not firm targets, but everybody is on board and everybody tries to work for a total overall productive economy without necessarily any enforcement of any tight regulations.

On the other hand, if they so wish, and the Japanese do, they tie monetary/fiscal policy to the incentive structure.

There is nothing impossible about what you are talking about in terms of goals, objectives, and implementation. It is just a question of really taking it seriously and applying these things. And the Japanese do it. It is simple, and it works.

Thank you.

[The prepared statement of Mr. Morse follows:]

Prepared Statement of Ronald A. Morse, Executive Vice President, Economic Strategy Institute

I should begin by pointing out that the Japanese would find little to argue with in the energy objectives outlined in the President's National Energy Strategy (NES). It calls for adequate energy at reasonable prices, protection of the environment, maintaining a strong economy, and reducing dependence on potentially unreliable foreign energy suppliers. What the Japanese do find hard to understand is why there are also no specific goals, and more importantly, why there are no government programs which translate these goals into policy.

The Japanese also believe that an effective energy strategy is the end product of a rather complex bottom-up consultative process. This of course is the opposite of the NES process. For the President to issue the NES and then present it to Congress, to the business community, and to the energy experts is putting the cart before the horse. For Japan, an energy strategy must also be embedded in a comprehensive economic strategy—a set of policies focused on productivity and job-creation. Japanese focus on what they can do to limit their domestic economic vulnerability because they are prohibited by their constitution from being a global policeman. They are forced to find economic solutions, not military options, to, among other things, their Middle East oil dependency.

Comparison of Major Advanced Nations' Energy Supply (1988)

	Japan	United States	West Germany	France	United Kingdom
Percent of dependency on:					
Foreign sources	82.3	16.2	52.5	52.9	•10.9
Oil	56.6	41.0	42.5	41.2	38.1
Oil imports	99.7	40.9	95.1	95.5	•48.0
Hormuz imported crude oil (1989)	57.5	21.8	14.7	29.1	

Sources: OECD Energy Balances (1987, 1988)., IEA Quarterly Oil Statistics (1989).

THE JAPANESE PLANNING PROCESS

Every two or three years Japan's Economic Planning Agency (EPA) prepares a five year national economic plan. This is the result of a complex and detailed consultative process. Based on this plan the government initiates a whole series of specific "visions" or "outlooks" for all other key policy areas including energy issues. This is an ongoing process.

The Japanese economic planning process consists of two key dimensions that seem to be missing from the U.S. National Energy Strategy: goal setting and policy implementation. Goal setting is a complex consultative process that is flexible and open to revision over time. It is the first stage in establishing the framework for timelines and specific components of a strategy.

Goal setting in Japan starts with leadership at the top—the Prime Minister's office calls for the plan to be done. This sends a signal to business, the bureaucracy, and the energy research community that something important is happening and they will be involved. The Prime Minister's energy advisory body then informs the Ministry of International Trade and Industry (MITI) to get the Advisory Committee on Energy to update the "Long-term Supply-Demand Outlook". Dozens of coordinating committees at several levels, involving hundreds of businesses, energy associations, and government experts are involved in the consultative process. (For more detail on the agencies involved in energy policy see the Appendix.)

These groups volunteer to participate in this process to obtain information because of the opportunity to be included in the prestigious membership, and also to represent their constituency interests on energy matters. This consultative, goal setting process helps the government come up with practical policies that reflect the best knowledge available. This process also gives the government the opportunity to shape private sector planning and views. The goals that are ultimately arrived at are published with the names of all the experts included. Everyone's views have been taken into consideration and they are expected to cooperate with implementation.

At this point the government has two other options. It can use its "informal" clout to get people moving in the desired direction. This "soft" approach is often referred to as "administrative guidance".

Japanese "Administrative Guidance"—Japan's paternalistic human relations and close government-business ties have made possible a non-legal, flexible, but powerful Japanese procedural practice called "administrative guidance", that provides a way around a cumbersome legislative process. Administrative actions can be taken by the bureaucracy without being legally binding, with the intention of influencing the actions of others toward administrative goals. They can cover regulation, conflict resolution, and advisory areas.

There is no direct equivalent in the legalistic and confrontational process in the United States. Persuasion by the U.S. President was intended to act in the same way but has no bureaucratic foundation. Japanese administrative guidance is not without its faults. Issues are not well defined, there is no eventual legal recourse for agreements arrived at, and application can be uneven. But it provides the cement that gives Japan an organizational edge—an edge, one might add, that frustrates American bureaucrats with a strong legalistic mentality.

Because energy policy is so important, the Japanese have usually resorted to "hard", direct policy implementation—the government brings fiscal and monetary measures in line with goals that have been set out. Policy implementation—changing the allocation of resources for production and industrial structuring—is often referred to negatively as "industrial policy" in the United States. The Japanese have no problem with this form of intervention. In the U.S., we also practice this through defense policy, agricultural subsidies, airline regulation, federal R&D spending, national highway programs, and space programs. The Japanese are willing to extend this energy policy because they believe comparative advantage can be created by successful control over the economy.

What the Japanese have in place administratively to achieve their domestic energy goals is straightforward. They have regulated the domestic oil industry (though that is slowly changing) and the key economic agencies monitor every aspect of domestic energy use. Conservation, fuel switching, research and development, diversification of source supply, and gasoline- and electric power-pricing are all controlled through a variety of formal and informal government-business arrangements. It is also important to emphasize that high energy prices have been the major factor in forcing conservation and energy efficiency in Japan and energy taxes are used to fund extensive programs in conservation, efficiency technologies, and alternative energy products, including nuclear energy. (See the Appendix for a comparison of U.S. and Japanese gasoline pricing.)

From a Japanese perspective, the U.S. Executive Branch policy process for preparing the NES includes only one dimension of a three stage Japanese process—leaving out the consultative and detailed goal setting process and seeking to avoid an implementation process. Setting out an energy strategy without prior advice and consultation and then pretending to leave the future of the U.S. economy up to the magic of the market is, from a Japanese perspective, the perfect formula for economic disaster.

Has the Japanese consultative and interventionist strategy been effective? It has reduced levels of Japanese oil imports. It has produced remarkable energy efficiency. It has induced fuel switching. It has stimulated new technologies. And, given the seriousness of Japanese bureaucrats about reducing levels of carbon intensity in the energy mix, their strategy should clean up the environment. The fact that Japan has had high growth rates, high productivity, rising real wages, and a favorable balance of trade with the United States in the 1980s is also evidence that their economy is doing better than ours. I would argue that an effective energy policy has contributed to their success.

Did the Japanese panic during the recent oil crisis? No. Their oil reserves were more than adequate. Windfall profits were prohibited by government monitoring of energy prices. The cost of higher oil prices was absorbed by producers and consumers. And economic growth has continued while the United States was in recession.

The Japanese are obviously production oriented. Consumer interests come second. This is because they believe that in the long-run, government is responsible for the total welfare of the nation. Special interests must be taken into consideration, but balanced against the long-term national interest.

Could we do the same? Of course, but we just don't apply these principles outside of the defense/national security area. Why don't we do it? Because our leaders simply don't understand or appreciate the importance of national "economic" security. Hopefully the message of this committee's proposals will be listened to very carefully.

APPENDIX

ENERGY IN THE POLICY PROCESS

The Japanese policy process is based upon a slow, mid-level bureaucratic, group-consensus process that emphasizes continuity and the importance of maximizing Japanese economic interests. As demonstrated once again in the current Middle East crisis, the Japanese apply a passive, adaptive process to new situations—a pragmatic, case-by-case approach. The downside of this process is the lack of responsiveness to allies' demands. New policies are based on a close but informal consultative mechanism between industry and government that seeks to minimize the economic impact of market forces.

Because of Japan's policy of controlling the energy process, bureaucrats are the main energy actors. And because these policies are part of the long-term strategy of Japan, there are few policy changes along the way. By the time a policy paper reaches the cabinet-ministerial-level, energy-advisory councils and other decision makers, a government- and industry-wide deliberative and consultative process has already taken place. This virtually ensures the implementation of the proposals. The key administrative organizations responsible for this process are the Science and Technology Agency (responsible for nuclear research and development) and the Ministry of International Trade and Industry (MITI), which has central responsibility for most areas of energy policy. The Agency for Natural Resources and Energy within MITI was created just before the 1973 oil crisis and is the focal point of Japan's energy policies. The Economic Planning Agency monitors energy prices.

In the broader consultative process, the Ministry of Education (university and research funding), the Environment Agency (pollution policy and regulation), the Ministry of Finance (budget support for national energy policies), and several other planning bodies have significant input. The Ministry of Finance has the final say on funding for energy R&D projects and energy programs. The Japan Atomic Energy Commission decides on matters related to research, development, and utilization of nuclear energy, including regulatory and licensing matters.

The Japanese parliament has had special committees on energy policy during critical times. Apart from the government structure, the ruling Liberal Democratic Party Political Affairs Research Council formulates its own policies on energy and R&D matters and reviews legislative bills and government programs on energy. Opposition political parties usually oppose nuclear power programs, but support most other energy plans.

Another major group is a loose alliance of business and industry interests. Private industry has an input into national energy policy through its participation in government advisory committees and through industrial associations or lobbying groups like the Japan Coal Association or the Federation of Electric Power Companies. The large Japanese trading companies handle petroleum import and export transactions worldwide and have specialized energy departments.

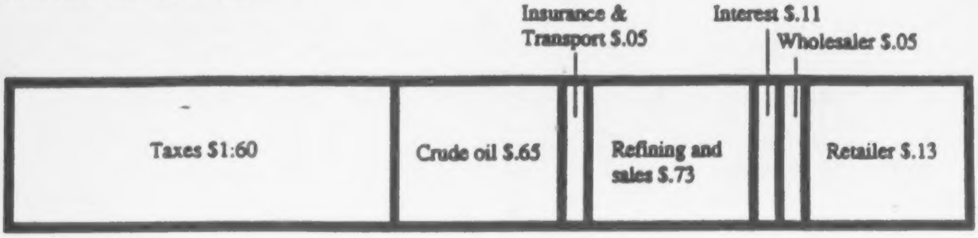
As new issues or initiatives arise (restructuring the oil industry, increasing coal imports, offering energy assistance to developing nations, and so forth), these groups or organizations make adjustments, reallocate resources, establish new committees, or call on experts to prepare studies. Though cumbersome, this consultative process has served Japan well during a difficult era.

Finally, there are private groups, independent experts, citizen groups, and the media—all interested in the ramifications of energy issues. Environmental protest groups and local citizen associations opposed to nuclear and other kinds of energy facilities have also been very effective in delaying or stopping a number of projects. Though these groups presently enjoy limited political backing, they are still important and must be taken into consideration in the government consensus process.

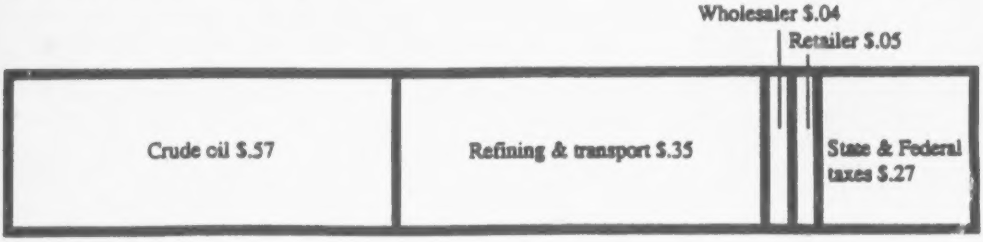
Japan has also been an active participant in international energy programs and a supporter of the International Energy Agency and nuclear safeguard agreements.

A Rough Comparison of Factors in Japanese and American Gasoline Prices Per Gallon

JAPAN: $3.40 per gallon



UNITED STATES: $1.28 per gallon



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Editorial Page
(Page 8-A, Col. 3)

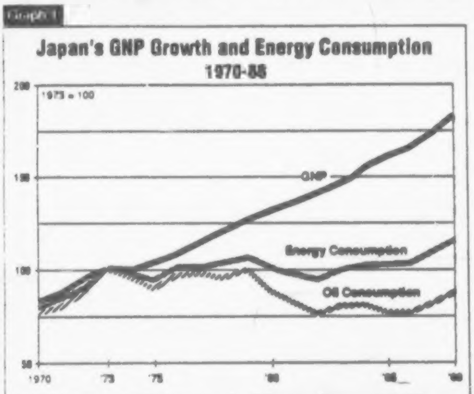
Japan Teaches Energy Lessons

By RONALD A. MORSE

Japan has been the focus of considerable negative attention during the Iraq-Kuwait crisis because of its complete dependence on the U.S. military to protect its energy interests in the Middle East. But the crisis also has brought into the limelight Japan's efficient energy policies over the past decade.

The United States could learn some important positive lessons from Japan's approach to energy. The U.S. de facto energy policy, which relies on military protection of Middle East energy supplies, is burdensome and costly. This reactive policy, in effect, subsidizes the national security of other countries that rely even more heavily on Middle East imports.

Graph 1



Japan's GNP Growth and Energy Consumption 1970-88

SOURCE: [illegible]

DOUG PINKERTON/Journal of Commerce

U.S. policymakers should consider what Japan has done, that is, to develop a sensible national energy policy that promotes energy conservation and enhances domestic competitiveness at the same time.

Japan imports over 80% of its energy supply, including 100% of its oil. So its primary goal is to ensure reliable supplies of oil, coal and natural gas at reasonable prices. This can be achieved in two ways — either by reducing demand and cutting political deals with producing nations (the Japanese preference) or by employing military means (the U.S. preference).

Given the limits of Japan's diplomatic options, a policy of minimizing energy import demand and pursuing conservation and energy efficiency makes the most sense. Tokyo has hedged against energy uncertainties by building stockpiles, investing in alternative energy technologies, diversifying the current sources of energy imports, restructuring the domestic petroleum industry and acquiring dedicated oil supplies abroad.

The results of these techniques: In 1973, oil made up nearly 80% of Japan's energy needs (76% of it imported from the Middle East) but by 1988 it had fallen to only 58% of total energy consumption.

Japan's record in sustaining high rates of economic growth, reducing oil consumption and controlling energy use is illustrated in Graph 1. It shows that Japan's economy produces 81% more real output for the same energy input as in 1973. Oil import levels also have remained constant.

Japan has regulated the domestic oil industry (though that is slowly changing) and the key economic agencies monitor every aspect of domestic energy use. Conservation, fuel-switching, research and development, diversification of oil supply and pricing of gasoline- and electric-power all are controlled through formal and informal arrangements between government and business.

Japan currently imports about 5 million barrels of oil a day. When we compare the U.S. and Japanese energy profiles in 1989, the result looks roughly as illustrated in Graph 2.

Japan's energy demand is about one-fifth of the U.S. level. Japan has virtually no domestic energy resources. Japan's overall energy efficiency (GNP/energy use in 1980 dollars) is higher than that of the United States — Japan uses about 30% less energy for its cars, homes, appliances and buildings than does the United States.

Japan and the United States have had very different priorities in their strategies to ensure energy security since the mid-1970s. Listed in descending order for each country, those include:

The United States:

- Contain Soviet expansion.
- Protect U.S. regional interests.
- Foster international cooperation on energy security.
- Build strategic oil reserves.
- Promote conservation and alternate energy supplies.

Japan:

- Diversify oil supply sources.
- Stockpile crude oil and offer economic and technical aid to supplier nations.
- Promote conservation and alternative energy.
- Stimulate energy production.
- Foster international cooperation.

The U.S. list starts with geostrategic considerations, with domestic energy control and conservation low on the list. Japan places its domestic oil stockpile, conservation and a shift away from Middle East dependency in higher priority than military or alliance schemes.

Washington did not respond to the first two oil crises with effective measures for energy conservation because it was overconfident of the U.S. military ability to shape world events. Thus, the first two energy crises resulted in no higher U.S. gasoline taxes or sustained energy policy. A supply-side, consumer-focused policy was employed.

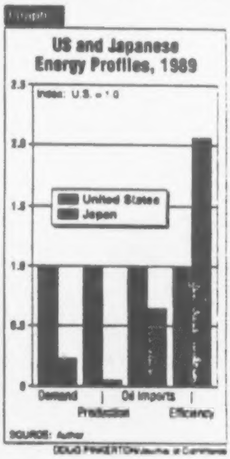
Tokyo, however, in 1974 called for higher gas prices, energy efficiency and conservation. The second crisis helped inspire the Japanese preoccupation with investment in technology.

Ironically, Japan's successful energy policies — including high domestic prices, big investment in energy research and development, tight regulation, high conservation awareness and superb industrial energy efficiency — could serve as a shock absorber to rising energy prices. That could keep the Japanese economy chugging along at a respectable growth rate, while relieving pressure on Japan to act vigorously in the Middle East.

The United States has been reluctant to formulate a long-overdue national energy strategy, which could deliver the same economic benefits in the 1990s that the Japanese enjoyed during the 1980s.

This strategy should achieve the following goals by the end of the century: a resolution to hold both carbon dioxide emissions and energy use as a share of GNP at their current levels, and serious plans to gradually reduce by 50% U.S. dependence on imported energy. Finally, the policy should provide economic incentives to stimulate domestic energy production, primarily that of natural gas, to fill the imports gap.

Graph



US and Japanese Energy Profiles, 1989

SOURCE: Author

DOUG PINKERTON/Journal of Commerce

Ronald A. Morse is the executive vice president of Economic Strategy Institute, a new think tank focusing on U.S. competitiveness, in Washington. Parts of this article are drawn from the author's article "Turning Crisis to Advantage: The Politics of Japan's Gulf Energy Strategy," published by the Asia Society in December 1990.

Senator BINGAMAN. Thank you very much.

The bill that I introduced calls for reports each 5 years. In light of some of the testimony today, I guess what I am hearing from various folks is that—I think your suggestion, Mr. Conant, was we have a periodic energy audit. Have often is the right time frame? Should this be an annual report? Should it be biennial? Should it be every 5 years? What makes sense?

Mr. CONANT. I would go, Mr. Chairman, on the assumption that for us to do anything meaningful in energy requires large amounts of new investment. That translates into time. I would think that a 3-year time, at least, and 5 years at the most would encompass the range of things in which you would begin to be able to measure what was happening.

Senator BINGAMAN. So you would say do a baseline report on where we are on these measures and then, say 3 years later, do another?

Mr. CONANT. Yes.

Senator BINGAMAN. No more than 5 years later.

Mr. CONANT. Exactly. For example, take in the case of domestic production of oil. You can have a very interesting measure on just 1 year's time by counting the oil rigs that are brought into use. This is a very good measure of a long-term possibility. But I would think that 3 years would be an effective time period.

Senator BINGAMAN. This is a question, not a statement, but do we not in fact generate monthly reports on the extent of oil being imported?

Mr. CONANT. Yes.

Senator BINGAMAN. So that information, it is a question of whether that is put together in a report that anyone releases, but that information is generated on a monthly basis?

Mr. CONANT. By a great many people.

Senator BINGAMAN. We have the annual Energy Outlook, I guess, from the Energy Information Administration. Does it have in there the essential information on the goals that I have identified here?

Mr. CONANT. It will have a great deal of it. And what is missing would be provided in their own periodic reports by, say, the National Petroleum Council or the API or other groups.

May I make one suggestion?

Senator BINGAMAN. Sure.

Mr. CONANT. If this national energy audit were to be heard and critiqued by a kind of permanent group from the Congress, executive branch, and the private sector—I am not thinking of more than perhaps 20 people, but who would stay with the responsibility—we would then have a continuity of analysis that I think would serve us well.

Senator BINGAMAN. So you are saying that instead of just issuing the raw data, we should have some analysis of it and some subjective opinion stated as to what it means for the country by a continuing commission or something?

Mr. CONANT. Yes.

Senator BINGAMAN. A commission on the National Energy Strategy or a commission on implementation of the National Energy Strategy or something like that?

Mr. CONANT. Right.

Senator BINGAMAN. You are referring to?

Mr. CONANT. We never had it. And as you pointed out, Mr. Chairman, there is a need to keep reminding the American people that there are energy options, and not just have it happen because Iraq moves in the Middle East.

Senator BINGAMAN. Mr. Morse, let me just ask you. In the vision or the reports that the Japanese have issued there on their plans with regard to energy, do they use the same indicators that we have identified?

We pared this down in the bill to these three areas. The measurement of oil consumption and imports of oil, the measurement of energy efficiency, and the measurement of the extent to which we use renewable energy. Are you familiar enough with the figures that they produced to know if those same indicators are the right ones, at least in their judgment?

Mr. MORSE. Well, I think—on two things. One, the Japanese issue, along the lines of the previous comment, 5-year statements. But they find that after 2 years, they have to be completely revised because, in fact, reality, depending on rises in consumption or other things, really changes that. So really what you are talking about is an ongoing constant, evaluative process, even though you do set out goals.

The other thing is the Japanese, because they have 100 percent import of oil, it is essentially an input-output situation. The Japanese do not even have the option of producing domestically. So basically what they do is measure everything in a very micro way. They have rather extensive alternative energy funded programs. They have extensive coal reduction—domestic coal is being phased out. They have had a 20-year plan to phase out coal. They measure everything in a very micro way, with statistical information that would blow the minds of most Americans.

So they keep a very, very careful watch on everything that takes place in the economy. Every improvement in energy efficiency, every breakthrough in solar wind energy, refinery production, efficiency in corporations. In companies there are coordinators for conservation, and so on.

They monitor the economy with tremendous care in a very complex way.

Senator BINGAMAN. Gentleman, the hour is late. I appreciate your taking the time to testify and prepare your testimony. I think it has been useful. We will conclude the hearing. Thank you.

[Whereupon, at 4:55 p.m., the hearing was adjourned.]

APPENDIXES

Appendix I

Responses to Additional Questions

Department of Energy,
Congressional and Intergovernmental Affairs,
Washington, DC.

Hon. Jeff Bingaman,
Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.

Dear Senator Bingaman: On July 18, 1991, Peter Saba, Principal Associate Deputy Under Secretary for Policy, Planning and Analysis, testified before your Committee regarding S. 1018, the Energy Goals Act of 1991.

Following the hearing, you submitted written questions on behalf of yourself and other members of the Committee to supplement the record. Enclosed are the answers to those questions.

If we can be of further assistance to you or your staff, please contact our Congressional Hearing Coordinator, Valerie Howard, on (202) 586-2032.

Sincerely,

Deborah L. Louison,
Principal Deputy Assistant Secretary.

[Enclosures.]

Questions From Senator Bingaman

Question 1. From the Administration's National Energy Strategy document, it would seem that the Administration sees merit in reducing our reliance on foreign oil. Would you say this was an accurate statement? Some economists argue that since energy is a global commodity, and in a truly free market the government would not try to limit oil imports. What is the Administration's view? How do you explain this discrepancy?

Answer. The Administration's National Energy Strategy (NES) sees merit in reducing our reliance on potentially unreliable energy supplies, whenever such reductions are economical and consistent with market principles. Recognizing that we are part of a complex and interdependent world oil and refined petroleum products market, the NES focuses its efforts on achieving greater energy security and economic efficiency, rather than limiting oil imports per se. Our intent is clearly stated in the NES report where it is written, "if fully implemented, the National Energy Strategy will make our country less prone to economic damage from violent fluctuations in either the supply or the price of petroleum." (Executive Summary, p.3)

This position is not at all at odds with the Strategy's keystone of continuing the successful policy of market reliance. With an eye to long-term objectives, the NES seeks to reduce dependence on potentially unreliable energy supplies by removing barriers to energy investment, efficiency and competition. This approach enhances and enforces free market forces. We view this as a valid and justifiable role for the Federal Government, not an intrusion into market economics.

While we favor economical oil import reduction, we do not support reductions in imports that are high cost and the result of government-directed "industrial policy"—that is plans made in Washington based on directives prepared by people who do not share in the risks resulting from those directives. An oil import policy that ignores costs and economics and that relies on government directives rather than the marketplace—no matter how well intentioned—is likely to be counterproductive, in our view. Experience in the U.S. and elsewhere demonstrates that such a policy would impose unnecessary costs on the economy without compensating gains in energy security. That approach can even interfere with energy security, by making the economy less flexible and less efficient.

Question 2. The various simulations provided with your testimony are obviously related to specific requests from elsewhere. Please explain the choices of scenarios.

An "analysis" is a function of the model used and the assumptions that go into it. Could you tell us a little more about the parameters that were used, such as the price of oil, and what assumptions are made about the structure of the economy, the industrial mix, and how it will evolve in the next decade or two?

Answer. In the NES analysis process a number of potential policy actions were analyzed quantitatively. These policy actions were incorporated in the NES integrating model (Fossil2) to analyze the impacts of all options simultaneously.

To analyze the effectiveness of S. 1220, the provisions of S. 1220 were translated into assumptions on research funding levels and changes in production costs. These assumptions were incorporated into the Fossil2 model to simulate the impacts of S. 1220 on energy demand and supply. The simulation of S. 1220 was done as part of the Department's analysis of this major legislative initiative.

To meet the targets set forth in S. 1018, we began with S. 1220 and tried to move energy demand and supply closer to the targets by selecting policy actions that can either reduce oil consumption or increase renewable production. Since S. 1220 can not meet all the targets set forth in S. 1018, a tax option with a $35 per ton carbon tax from 1992 through 1995 and a $135 per ton thereafter, was included to reduce total primary energy consumption and to encourage use of renewables.

Because reducing the supply of non-renewables would raise prices, and consequently, lower demand for non-renewables, an additional simulation was performed which eliminates certain non-renewable supply options proposed in S. 1220 to examine if that approach can reduce primary energy demand and meet energy targets. These options included increased access to the Arctic National Wildlife Refuge, nuclear research and development, nuclear regulatory reform, natural gas regulatory reform, and advanced oil recovery R&D. These additional simulations (Simulations 2 and 3 in the table attached to the written testimony) were done specifically in preparation for the hearing on S. 1018. The choices of scenarios were based on economics of demand and supply, and a good understanding of the energy market.

The price of oil was taken from the NES Current Policy Base case. Oil prices are projected to be $21.21 (1990$) per barrel in 1995, $29.26, $34.95, and $39.29 per barrel in 2000, 2005 and 2010, respectively.

Assumptions on the structure of the economy and the industrial mix were taken from DRI macroeconomic reports. A word of caution is called for in interpreting any of these simulations. These simulations are subject to the same limitations regarding the great uncertainty associated with any projections of future events that is discussed more fully in response to your Question 7. For example, energy projections in the past have failed to reflect the flexibility of the market to respond to changing conditions. Consequently policy decisions need to be based on sound market principles rather than central government planning through modeling.

Question 3. Why does the NES evaluation of the S. 1018 goals vary so dramatically from Mr. Chandler's assessment?

Answer. Mr. Chandler's assessment primarily addresses three points:

1. Do the goals of energy efficiency improvement, and reductions in oil imports and carbon emissions have merit? We agree with setting broad goals such as improving energy efficiency.

2. Does goal-setting itself have value as a sort of report card system? As I mentioned in my testimony, we very much support keeping score or measuring our progress toward appropriate national energy, economic, and environmental goals.

3. Are the targets reasonable? Mr. Chandler finds them to be plausible, but requiring additional policies such as taxes and more emphasis on research and development. As I stated in my testimony, our preliminary analysis indicates that all of the S. 1018 targets would not be met in 2010 even with the addition of a crippling $250 per ton carbon tax. However, our analysis also indicates that S. 1220 reaches sufficiently close to the goals of S. 1018 without imposing undue burdens on the economy.

Question 4. You point out in your testimony that oil consumption in this country is strongly driven by use in the transportation sector. And as you note, the fuel economy of vehicles has improved significantly over the last 15 years—a result of federally mandated requirements. Obviously, government-imposed standards can be effective and do not necessarily destroy the economy. I find it strange that CAFE standards were not included as part of your scenario. How do your results change if

CAFE standards as (a) proposed by Senator Bryan and (b) proposed by Senator Johnston are included?

Answer. While my testimony noted the significant improvement in the fuel economy of light duty vehicles, it did not attribute this increase to Federally mandated requirements. The question has often arisen about what factors (e.g., higher gasoline prices, heightened consumer awareness of the importance of automobile fuel economy resulting from the oil price shocks of 1973/74 and 1979, Corporate Average Fuel Economy (CAFE) standards) contributed the most to this impressive improvement in fuel economy. Several studies have analyzed the relative role of higher gasoline prices versus standards in explaining the improvement of domestic automobile fuel economy. Some studies have indicated that fuel prices were the primary factor, while other studies have indicated that standards may have played a more prominent role. We do not believe that these studies have conclusively answered this question because too many variables were changing at the same time, and it is difficult for statistical studies to separate the influence of one factor versus another when this is occurring. Note in addition that improvements in energy efficiency were as significant in the residential and commercial sectors as in the transportation sectors over the period in question. Regulation in those sectors was minimal. underlining the relevant point that markets alone could have accounted for most or all of the energy efficiency improvements in the United States.

With respect to your specific questions on the impact of Senator Bryan's proposal and Senator Johnson's proposal on CAFE:

(a) On the basis of information that is available, we do not believe that the CAFE standards proposed by Senator Bryan in S. 279 are achievable from the standpoint of technology, cost and economic practicability.

Assuming they were, the following table presents the results for the S. 1220 scenario with the Bryan CAFE bill. The comparable table for S. 1220 without the Bryan CAFE bill is provided in response to Question 10.

	1995	2000	2005	2010
Efficiency (GNP/quads)	71	76	84	91
Percentage of target	98	94	91	84
Renewables (percent of total)	8.5	8.9	10.2	10.7
Percentage of target	94	89	85	76
Oil consumption (percent of total)	37.9	36.5	36.2	35.8
Percentage of target	103	101	97	92
Oil imports (percent of total oil)	55	49	41	45
Percentage of target	92	102	121	110

(b) We cannot make a reasonable assessment of the impact of Senator Johnson's CAFE standards on oil consumption because standards are not specified.

Question 5. In the business world, setting production targets is a normal part of the planning process. It is a statement of what the company seeks to achieve. Can you explain why a similar approach would not be helpful in the context of the nation?

Answer. The business world sets production targets that continually change in response to market signals. Their responses to those market signals are a matter of private decision-making and not a matter of Government-imposed targets.

The problem with basing policies on targets set by the government include the following:

- They tend to be based on political rather than economic considerations.
- Government-set targets involve little or no accountability. By way of contrast, private firms that set profitable targets make money; those that guess wrong are penalized by losses and bankruptcy. Incentives in the private sector to set realistic targets are strong; they are weak in the public sector.
- Government-set targets tend to be inflexible. They are rarely updated in light of changed circumstances. Updating legislatively-set targets requires further legislation—a complex and time-consuming process.
- Implementing government-set targets is difficult to do if they are at odds with the verdict of the market. Obviously it is not sufficient to set targets; to be effective, companies need incentives to achieve them. But the government lacks the data needed to fine tune incentives to achieve the targets, and the likely results would be economic inefficiencies and wasted resources.
- Government-set targets are confusing to the private sector and can easily be counterproductive. Companies can operate under a market-based profit and loss system. If you set up a second system, you create mixed signals. Companies quickly find they can make money coming to Washington to lobby for higher

targets and larger subsidies for their favored fuel. A government target system tends to dilute market incentives.

These are not merely abstract arguments. The failed experiences of the U.S.S.R. and the centrally-planned economies of Eastern Europe illustrate the advantages of market based versus government target-based systems.

This Administration believes the keystone of any successful energy strategy must be reliance on free and competitive markets. Market signals need to reach all energy producers and consumers in a clear, consistent and realistic way. The energy targets of S. 1018 are arbitrary and inflexible and do not reflect a balanced energy strategy.

Question 6. If, as you state in your testimony, (p. 21 of the hearing transcript), the Administration does not object to energy goals, could you tell the Committee which goals the Department thinks are appropriate to include in S. 1018?

Answer. As I mentioned in my testimony, we do not oppose goals per se, but we are concerned about setting specific targets. Broad general goals such as energy security, energy efficiency, and environmental protection are common to NES, S. 1220, and S. 1018. We believe that specific targets, however, are blunt and imprecise tools that will impose unforeseen costs by reducing the flexibility of the economy.

Question 7. Mr. Saba, in your testimony you state that projections by OTA and DOE are inherently unreliable. (pg. 23 of the hearing transcript.) Could you explain this view?

Answer. Any projection of future events involves great uncertainty. The OTA and DOE energy projections are no exception. While the DOE projections are developed with the aid of complex computer models that represent energy markets, these models are dependent on their assumptions. Many of these assumptions, such as economic growth, energy technology costs and energy resource levels cannot be known with certainty. Therefore, the point estimates provided by the models cannot be interpreted as precise and, thus are an unreliable guide to the future. What the models do provide is a sense of the relative importance of specific policies and technologies. In the NES analysis, changes from the baseline resulting from policy actions were the critical measure of the effectiveness of an action; the absolute levels, or point projections from the analysis were far less meaningful due to the inherent uncertainty of any long-range energy projections.

As discussed more fully in *Technical Annex 2, Integrated Analysis Supporting the National Energy Strategy: Methodology, Assumptions, and Results,* sensitivity analyses to address uncertainty regarding economic growth and world oil prices were performed. The results of these sensitivity analyses indicate that the NES conclusions are robust with respect to the assumptions tested—they do not change significantly when these assumptions are modified.

More generally, the NES did not use modeling or projections to set targets or establish a plan to achieve certain levels of fuel use. The models and projections were used as tools to assist in the NES analysis of policies based on market reliance. The NES continues the successful policy of reliance on markets for a variety of reasons, including the fact that reliance on central planning or on models does not work. Past efforts to plan the U.S. energy economy based on computer forecasts—such as the synthetic fuels corporation—resulted in considerable waste. We need to be forthright on the limitations of these models so that Congress fully appreciates why we believe relying on markets rather than on government models or targets is critical.

Question 8. Could you provide the Committee with information as to what the Department believes S. 1220 will accomplish in the next ten years with regard to the goals in S. 1018 (pg. 24 of transcript)

Answer. S. 1220 will accomplish the following with respect to the S. 1018 goals:

- S. 1018 sets an annual goal of 2 percent improvement in efficiency. Our preliminary analysis shows that S. 1220 will reach an annual average of 1.5 percent improvement for the period between 1991 and 2000, or 77 percent of the target.
- S. 1018 would require renewables to meet 10 percent of our energy demand by 2000. Our analysis shows renewables contributing 8.6 percent in 2000 under S. 1220, or 86 percent of the target.
- The oil import ceiling goal of 50 percent would be met by S. 1220 in 2000.
- S. 1018 would require that the oil contribution to our total energy consumption be no more than 37 percent in 2000. Our analysis shows that the oil percentage would be 36.7 percent under S. 1220 in 2000, exceeding the goal.

Question 9. You stated at the hearing that under S. 1220, the Department must submit a least-cost plan and that "we [DOE] believe that this is the kind of approach that we should be taking in the energy area." (pg. 32 of the transcript.) Does this mean the Department supports least-cost planning for the development of a National Energy Strategy?

Answer. The quoted statement refers to the general discussion at the hearing regarding the current statutory requirement to submit a national energy policy plan (NEPP) every two years, the Department's intention to submit subsequent editions of the National Energy Strategy in fulfillment of that requirement, and the provision in S. 1220 that would require subsequent NEPPs to include a "least-cost energy strategy." The quoted statement should not be interpreted as an endorsement of the specific provisions in S. 1220 regarding the submission of a "least-cost energy strategy."

The Department supports least-cost energy planning that relies, to the maximum extent possible, on market mechanisms and the removal of market barriers. We do not support least-cost energy planning that uses command and control policies to limit choice in a manner that restricts the ability of consumers to meet their individual needs for energy and other services at the least cost.

Question 10. Could you provide the Committee with estimates for where we would be in 1995, 2000, 2005, and 2010 for S. 1220 just as you have done for the NES in 2010? (pg. 34 of the transcript)

Answer. The following table presents the results for the years requested.

	1995	2000	2005	2010
Efficiency (GNP/quads)	71	75	82	88
Percentage of target	98	93	88	81
Renewables (percent of total)	8.4	8.6	9.5	9.9
Percentage of target	93	86	79	70
Oil consumption (percent of total)	37.9	36.7	36.8	36.2
Percentage of target	103	101	95	91
Oil imports (percent of total oil)	55	50	43	47
Percentage of target	92	101	115	106

Note that in some cases we estimate the target is more than achieved; in other cases it is only partially achieved. Two important caveats:

- No one, including DOE, is capable of forecasting with sufficient precision to say today what will be achieved and what will not be achieved. Our forecasts, for example, have a range around them; point estimates are presented above. We may or may not achieve the targets.
- Whether we achieve fixed targets or not, in our view, is not critically important. What is important is that we have in place policies that encourage the sound development and use of all the nation's resources, including energy. A market-based system is such a policy. A policy which focuses on targets is not such a system for the reasons outlined in earlier answers.

QUESTIONS FROM SENATOR WELLSTONE

Question 1. Mr. Saba, your testimony indicates that the Administration believes in reliance upon a "free market" to resolve our energy problems. I assume that this "free market" reliance is accompanied by a belief in a "level playing field" between competing energy options.

Several years ago, under a previous Administration, there were studies produced by organizations such as the Battelle Memorial Laboratory, which indicated that the government was providing tens of billions of dollars in subsidies to the conventional energy industries. A more recent study by the Rocky Mountain Institute concludes that these subsidies amount to over 40 billion dollars annually.

(a) Does DOE agree that there are direct and indirect subsidies which distort the marketplace?

Answer. The Department would agree that there are direct and indirect production and consumption incentives and disincentives. Broadly speaking, any government action which affects economic activity has an impact on the production and consumption of energy. While the linkage of actions and events is more obvious in some cases than in others, the pervasive role of energy in economic activity ensures that this is true.

Question 1(b). Has DOE prepared any updates to these studies which examine the comparative direct and indirect subsidies to different energy sources, or, has DOE prepared any studies that refute these earlier studies and demonstrate that there is, in fact, a level playing field in the energy marketplace? Can you provide them for the Committee's hearing record?

Answer. We have not updated the quantification of these energy incentives and disincentives. One shortcoming of the past studies was that they concentrated on incentives without netting out the disincentives. This partial accounting provides a very biased view of government action in the energy marketplace.

It may very well be impossible to conduct a complete quantitative estimation of both incentives and disincentives in order to derive a net subsidy estimate. The general consensus in the literature is that the quantification of incentives is difficult, but the quantification of the disincentives could be impossible. If a more precise definition of net subsidy is desired, it would be necessary to quantify and net out the benefit estimates from regulatory costs.

The quantification of interaction effects has not been attempted. The effects of interactions among federal actions, among state/local actions, or between the federal and state/local levels may be significant.

The difficulties are legion; the rewards are uncertain. What is the utility of an incomplete and static portrait of a dynamic process? It is not clear that it is possible to address this subject in a manner which would yield valuable policy insights.

Question 2(a). According to an article published by one of our other witnesses today, Mr. Ronald Morse, in the *Journal of Commerce* "The U.S. de facto energy policy, which relies on military protection of Middle East energy supplies, is burdensome and costly." Mr. Saba, would you agree with Mr. Morse's assessment and how are those costs reflected in your free market place?

Answer. I do not agree with Mr. Morse's assessment. In the article to which you refer, Mr. Morse compares the United States unfavorably with Japan's interventionist energy policy. He cites approvingly the Japanese policy of "cutting political deals with producing nations" and regulating many aspects of the Japanese oil industry through formal and informal arrangements between government and business. The Administration's energy policy rejects those practices. It is based primarily on market reliance, which means that in most instances we prefer letting markets determine prices, rather than government agencies. The NES is an example of a market reliance policy that at the same time looks for cost-effective ways for the Government to augment market outcomes (such as investment in a Strategic Petroleum Reserve) and remove market impediments (such as eliminating regulatory barriers to more efficient natural gas transportation).

Further, U.S. energy policy does not rely on military protection of Middle East energy supplies. For example, when the Iranian Revolution in 1978-79 caused Iranian production to drop from over 5 million barrels per day to under 500,000, the United States did not intervene to start the oil flowing again. It was foreign policy, not energy policy, that drove the decision to use military force to reverse the Iraqi aggression against Kuwait.

Question 2(b). Mr. Saba, according to the international assessments which has been conducted by the IPCC (intergovernmental panel on climate change) continued use of fossil fuels could lead to the inundation of many coastal areas of the United States. For example, much of the state of Louisiana could be flooded in the next century due to climactic change. In previous testimony, Ms. Linda Stuntz of the Department indicated that such externalities were factored into the cost-benefit analyses of the NES. Is that correct? Perhaps you could explain, then, how does the market-place factor these costs into its choices of energy sources?

Answer. Externalities were not included in the cost-benefit analyses that were conducted as part of the NES. The marketplace does not automatically account for (or internalize) the costs or benefits imposed on those who are not parties to market transactions. However, legislation such as the Clean Air Act Amendments, the Clean Water Act, and the Resources Conservation and Recovery Act, among others, all impose requirements that must be borne by manufacturers and ultimately by consumers. The additional costs associated with these requirements change economic behavior and, as such, represent the internalization of many environmental costs and benefits.

The Department is currently engaged, with the European Community, in the External Costs of Fuel Cycles study, which seeks to develop a methodology for performing full fuel cycle analyses that could be utilized in evaluating alternative energy resource options. This effort will attempt to ascertain how best to include both the costs and the benefits associated with particular energy resource options. It is a difficult undertaking involving highly contentious issues. Preliminary results should be available next year. Because there are currently so many "external cost" estimates being made without a proper scientific basis, one of the Department's goals is to provide a definitive fuel cycle study that will set the standard by which existing work will be measured. It will also establish a framework for future public and private work in this area.

Specifically, with respect to the issue of potential sea level change raised in your question, the Policymakers Summary of the Intergovernmental Panel on Climate Change (IPCC, June 1990) states that "Global mean surface air temperature has increased by 0.3 degrees Centigrade to 0.6 degrees Centigrade over the last 100 years, with the five global-average warmest years being in the 1980's. Over the same period global sea level has increased by 10-20 cm. These increases have not been smooth with time, nor uniform over the globe. The size of this warming is broadly consistent with predictions of climate models, but it is also of the same magnitude as natural climate variability. Thus the observed increase could be largely due to this natural variability; alternatively this variability and other human factors could have offset a still larger human-induced greenhouse warming. The unequivocal detection of the enhanced greenhouse effect from observations is not likely for a decade or more." In addition, the recent study by the National Academy of Sciences concluded that "there is a reasonable chance . . . [that] a rise of sea level may accompany global warming, possibly in the range of 0 to 60 cm (0 to 24 inches)" for a doubling of CO_2 (Policy Implications of Greenhouse Warming, pp. 25-26).

Given the level of uncertainty identified in these reports, which is consistent with the scientific data base, the development of a specific externality such as sea level change relative to the use of fossil fuels is not appropriate. Much work still needs to be done to develop a clearer understanding of the linkage between energy-related greenhouse emissions and sea level through the climate system, as well as the costs and benefits of mitigation and adaptation to a possible sea level rise.

Question 3. According to the Office of Technology Assessment, "many of the details of the NES analytical process are just now appearing in the series of Technical Appendix documents being prepared by DOE."

(a) Has DOE published all of the background documents?

Answer. DOE is currently in the process of publishing the background documents.

Questions (b-e). Do these documents fully reflect the analysis and decision making which went into the NES—in other words can someone take those documents and reproduce the calculations which led to the NES conclusions? Why has it taken DOE almost six months to make available for critical review the analysis which underlies its conclusions in the NES? Don't you think a review of the analysis would have been appropriate before publication of the conclusions? Who outside of DOE and its various contractors has reviewed the complete analysis?

Answer. In the fall of 1990, DOE made available to the public a summary of the analyses of the National Energy Strategy options. These summary options were reviewed by trade organizations, environmental groups, energy producers, consumers, conservationists, and others. Members of the Secretary of Energy Advisory Board, coming from the private sector, nonprofit groups, academia, and State and local governments, also volunteered their time to provide individual and independent assessment of the Strategy analyses. A final review was undertaken by the Economic Policy Council, and five Cabinet meetings were conducted, two of which were led by the President. The product of those meetings is the NES comprehensive package of action items.

Question 3(f). In looking through some of the documents DOE has made available, my staff has been unable to find any explicit comparative analysis of investments in new electric generating capacity with investments in demand side efficiency—can you provide the Committee with that analysis?

Answer. The NES modeling did not directly compare the cost of demand-side efficiency investments with the cost of new generating capacity in deriving NES projections of the amount of generating capacity needed in the electricity industry. Methods for directly comparing the cost of demand-side and supply-side resource options for providing electricity services are relatively new and changing rapidly.

The demand-side management (DSM) savings identified in the NES integrated resource planning (IRP) analysis generally have costs below the average electric utility avoided cost. Assuming implementation of the NES IRP actions, many of these investments would therefore be made before substantial investments in capital expansion would be made. The DSM investment gains estimated are based on energy conservation cost curves developed by Lawrence Berkeley Laboratory, while the avoided cost calculations are based on the electricity generation technology assumptions of the NES.

These data are described in *NES Technical Annex No. 2.* The conservation that customers adopted, based on these cost curves and other underlying assumptions (e.g., energy prices), was included in NES projections as a deduction from aggregate electricity demand.

Question 3(g). The NES analysis of the effects of demand side management appears to be far lower than estimates made by the private sector. For example, analyses by PG&E and Northeast Utilities show a potential for much greater savings per dollar invested than DOE's technical annex. Can you explain this difference?

Answer: A major reason for the difference is many studies identify the engineering potential of demand-side management (DSM), without identifying policy actions that could achieve that full potential. In contrast, the NES IRP actions analysis identifies the potential energy savings resulting from the implementation of the NES actions. The full potential of DSM is admittedly greater, but many of the actions necessary to realize that potential must be taken at the state and local utility level.

In addition, the projections of demand-side potential identified in most studies assume the use of utility rebate programs in which the rebates are not taxable. The IRS has recently ruled that energy conservation-related utility rate reductions or nonrefundable credits are not taxable. However, other rebate programs such as direct cash rebates are taxable, and this may significantly lower achievable energy savings assumed in these other studies.

It is also important to recognize that the NES, with its reliance on market mechanisms, may yield less demand savings than studies which assume nonmarket mandates for conservation. Although mandated programs could yield greater savings, they are generally not the most economically efficient approach and could lead to economic losses.

Question 3(h). Mr. Saba, I understand that the analysis used in the NES for CAFE standards included a "hedonic variable." Can you explain to me what a hedonic variable is and how it was factored into the NES conclusions on auto standards?

Answer. Hedonic variables are used in the analysis of consumer choice. These "hedonic" variables quantify various non-price attributes of the product that have an effect on consumer choice and can be used in such a way as to account for variations in the population of consumers, such as income, family size, education, and other consumer characteristics. Consumer choice models for automobiles typically involve multinominal logit analysis in which several marginal and conditional probability equations are accounted for in estimating consumer demand. These models estimate the probability of consumer choice as a function of the attributes of the product for which consumer demand is being estimated. The attributes affecting consumer demand include price and several "hedonic" variables. An excellent summary of hedonic choice models as applied to motor vehicles is provided by Timothy J. Tardiff, "Vehicle Choice Models: Review of Previous Studies and Directions for Further Research," *Transportation Research,* Vol. 14A, No. 5-6, October-December, 1980.

In analysis prepared for the National Energy Strategy (NES), two hedonic variables were accounted for: vehicle performance, and vehicle weight. The NES analysis assumed that vehicle interior size was held constant and, therefore, there was no need to use a hedonic variable for vehicle size. The NES analysis did not employ a specific hedonic choice model but did utilize results from these models in order to estimate the importance of vehicle weight and performance to consumers. Based on our review of this literature, we concluded that vehicle performance does have value to the consumer and used a mid-point estimate of $20 per 1% change in the horse power to weight ratio. For example, if the horsepower increased by 20% and weight remained constant, the consumer would be willing to pay an additional $400 for the vehicle. Clearly, some consumers are willing to pay more, and some less. This is an estimated average value that takes into account that many consumers are not willing to pay as much for increased performance and that some consumers may regard increased performance as a negative feature.

In addition, we concluded that the principal value of weight to the consumer is its perceived effect on safety. We therefore estimated the (negative) value of weight reductions based on their estimated effects on safety. From this, we estimated the impact that these safety impacts would have on consumer behavior and estimated the increased injuries and fatalities resulting from decreased weight.

Our weight related estimates were based on information provided to us by the Department of Transportation that 1340 fatalities and 6300 injuries would result per 1000 lbs. of weight reduction (applied to all U.S. vehicles). By using DOT's estimates of the cost of consumer's willingness to pay for increased safety of $2,000,000 per fatality and $95,000 per serious injury, we derived a net present value per lb. of weight of $0.16. These hedonic variables were used to estimate effects on vehicle sales and scrappage rates.

Question 4. I find it difficult to evaluate the veracity of your statements without the details of the analysis and an independent review of your analysis.

(a) Have you or your Department made available to OTA, or others, for critical review the analysis which your statement is based upon today? Can we please be provided with the results of any such analysis?

Answer. The preliminary analysis described in my written statement was essentially a set of computer simulations run on the Fossil2 model to compare the likely impacts of S. 1018 and S. 1220. While these particular runs had not been reviewed by OTA or others prior to submission of my statement, the Fossil2 model has been reviewed extensively. Simulation results on S. 1220 are currently being reviewed by CRS and GAO.

Question 4(b). Is the analysis underlying your testimony today based upon the Department's Fossil2 computer model? Isn't this the same program which supported the energy analysis of the Carter Administration? Could you explain how this model is capable of justifying such radically different policies?

Answer. NES policy recommendations were based on market principles. Computer simulations were used as a tool to assist the NES analysis, but they are not a substitute for the policy of market reliance. It is important to communicate this clearly to the Congress so that we do not create the illusion that DOE (or any other group for that matter) has the ability to centrally plan the country's energy future. As most modelers will attest, neither we nor any other modelers are capable of modeling the economy in sufficient detail to base policy-making on modeling alone.

With respect to the NES analysis process, we used a large number of computer models. In general, detailed fuel- and sector-specific models (e.g., a residential energy model) were used for the analysis of specific actions. The Fossil2 National Energy Model was used to integrate the results of the more detailed models and "clear" energy markets (i.e., balance supply and demand). Once calibrated to the more detailed models, Fossil2 was used for sensitivity analyses. The analysis underlying this testimony used the Fossil2 model as part of the larger NES analysis framework.

The current Fossil2 model bears little resemblance to the models used by DOE in the late 1970s. The first version of the Fossil2 model, Fossil79, was a coal, oil and gas model that was used at the end of the Carter Administration. However, the model has been completely rewritten several times as our understanding of energy markets has improved. For example, the oil and gas production sectors were re-written in 1990, the electric utility sector was redone in 1988, and most of the end-use sectors were re-written in 1986. The current Fossil2 model is a much more sophisticated and more accurate representation of energy markets than the original Fossil79 model.

The energy policy analysis results of the NES are quite different from the policy conclusions of the Carter Administration. This is because the energy policies, energy models and assumptions underlying the models are all substantially different today. Thus the "same models" were not used to "justify" different policies. In fact, models were used in the NES analysis process not to justify policies, but to evaluate the potential impacts of policies. Results of all models are dependent upon the analysis assumptions—different assumptions (e.g., technology costs, market mechanisms) can lead to different outcomes. Our understanding of energy markets and technologies has evolved considerably in the last 12 years and the NES analysis process reflects that greater understanding.

Question 4(c). Has anyone outside of DOE or its contractors ever evaluated the analytical accuracy of this computer model? Could you provide the Committee with any such analysis?

Answer. As part of the ongoing model development process, Fossil2 has been extensively reviewed by outside experts and has been the basis for numerous published articles. The model was utilized in several studies of the Stanford Energy Modeling Forum, where teams of modelers address various policy issues in order to test and validate the models. In addition, the model has been reviewed by individual DOE laboratories—including Battelle Pacific Northwest Laboratories, Sandia National Laboratories, the Solar Energy Research Institute and the Argonne National Laboratory. Comments from these reviews form part of the basis for ongoing model development. Finally, the entire NES modelling process, including Fossil2, was reviewed by the National Academy of Sciences as part of the NES process.

QUESTIONS FROM THE MINORITY

Question 1. Current law requires the Secretary of Energy to submit a biennial national energy plan to the Congress. In compliance with this requirement, earlier this year, after public hearings, the President submitted the First National Energy Strategy to the Congress.

(a) In your judgment, does the First National Energy strategy represent an improvement of previous submissions?

(b) Do you support a continuation of such biennial submissions?

(c) In the preparation of President Bush's National Energy strategy there was a reliance on public hearings, do you support such a procedure?

Answer 1(a). Yes. The National Energy Strategy represents the most comprehensive effort undertaken in the last two decades to assess energy production, transportation and use. Unlike previous policy plans developed by the Department of Energy, the National Energy Strategy involved extensive public and interagency participation. Final decisions were made by the Cabinet and the President. The National Energy Strategy carefully articulates for virtually every Federal agency an agenda for action.

(b). We intend to comply fully with the requirements of the law, however we are willing to work with the Congress in reevaluating the need for biennial submissions. In addition and importantly, we believe that the energy targets provision of the law needs to be repealed. The government is simply not capable of producing energy targets that are reliable, except with a wide band of error. Such targets are not useful. They create the impression that centralized planning is feasible; experience indicates it is not feasible, as evidenced by the problems now facing countries (e.g. in Eastern Europe) that have attempted to regulate their economies through models rather than through markets.

(c). Yes. Extensive public participation was vitally important to the development of the National Energy Strategy. It increased both the breadth and the depth of the information we needed to address the comprehensive range of institutional and regulatory barriers we face. The information gathering phase resulted in an extensive public record. Midway through the process, in April of 1990, we published a compilation of public comments in the form of an Interim Report. The Interim Report further stimulated the public debate and as we moved from the information gathering phase to data analysis and policy recommendations public comments and review of options provided valuable feedback.

Question 2. S. 1220, as reported by this Committee, requires future national energy plans contain a "least-cost" national energy strategy that reflects the use of integrated resource planning.

(a). Do you support the formulation of a national energy strategy that reflects the concepts as "least-cost" planning or integrated resource planning?

Answer. The Department supports least-cost energy planning that relies, to the maximum extent possible, on market mechanisms and the removal of market barriers. We do not support least-cost energy planning that uses command and control policies to limit choice in a manner that restricts the ability of consumers to meet their individual needs for energy and other services at the least cost.

Question 2(b). Do you consider the goals and objectives of S. 1018 as consistent with the provisions of S. 1220 as I have described them?

Answer. No. S. 1018 establishes arbitrary targets for reduced oil consumption, increased energy efficiency, and utilization of renewable energy and requires the Secretary of Energy to submit a plan for the achievement of these targets. A major concern is that there is no consideration of the cost-effectiveness of these targets. Even if technically achievable, such targets could seriously harm the U.S. economy by saddling it with an unnecessarily expensive energy supply system if their attainment becomes an objective independent of future costs or conditions. S. 1220 conversely, requires the Secretary of Energy to evaluate a wide range of energy supply and efficiency technologies in developing a least-cost energy plan and to fully consider the economic, social, and environmental consequences of his choices. The focus of S. 1220 is on identifying desirable policies and implementation strategies for these policies. S. 1220 recognizes that the achievement of projected policy results cannot be guaranteed up front, because policy impacts and market conditions may both differ from forecasted values. It therefore does not require the Secretary to meet predetermined energy targets. As a result, the plans required by S. 1018 and the least-cost plans required by S. 1220 are likely to be inconsistent.

Question 3(a). Do you agree that formulation of a national energy strategy should not be an objective in its own right, rather national energy policies should be viewed as a means for achieving broader social objectives such as national security?

Answer. Yes, energy policy is only important insofar as it plays a role in broader social objectives.

Question 3(b). In your judgment, are the specific goals and objectives of S. 1018 flexible enough to address these broader objectives?

Answer. No. While the general goals of S. 1018 may be laudable, the mandatory targets it establishes are not. The flexibility of our energy market system as defined by the countless individual decisions by producers and consumers as they adjust to price signals is at the core of our dynamic economy. We should not try to limit this flexibility by setting U.S. energy targets. In addition, the focus of policy needs to be world energy markets not the U.S. A companion reason we believe U.S. energy targets are inappropriate is that they neglect international developments and opportunities (for example, in the Middle East, Eastern Europe and Japan) which have an important bearing on U.S. energy and other interests.

Question 4(a). Do you agree with the objectives of the National Energy Strategy which call for adequate energy at reasonable prices, protection of the environment, maintaining a strong economy, and reducing dependence on potentially unreliable foreign suppliers?

Answer. Yes, I do agree. And the objective of the National Energy Strategy, as established by President Bush in July 1989, reflects that. He defined our energy policy objective as:

> achieving balance among our increasing need for energy at reasonable prices, our commitment to a safer, healthier environment, our determination to maintain an economy second to none, and our goal to reduce dependence by ourselves and our friends and allies on potentially unreliable energy suppliers.

Question 4(b). In your judgment, do the specific goals and objectives of S. 1018 adequately reflect these broader objectives?

Answer. While S. 1018 does address part of the environmental protection and energy security goals, it does not address the economic and equity goals.

Question 5. The objectives of S. 1018 call for specific reductions in oil consumption, specific increases in energy efficiency and specific increased utilization of renewable energy, by certain dates.

In your judgment, can an effective national energy plan be formulated if its objectives are restricted to those specifically enunciated in S. 1018?

Answer. No. Our preliminary analysis suggests that costly, inflexible, and potentially crippling measures would be required to achieve all of the specific targets fully. We do not believe that an effective national energy plan can result from such a top-down approach. Moreover, as noted in response to Question 4, S. 1018 does not address all of the broad objectives that must be balanced to achieve a truly effective national energy strategy.

Question 6. Mr. Morris states that, "For Japan, an energy strategy must also be embedded in a comprehensive economic strategy—a set of policies focused on productivity and job-creation."

(a) Would you agree that for any energy strategy to be effective it must be embedded in a comprehensive economic strategy?

(b) In your judgment, does S. 1018 embody this interrelationship?

Answer. We are trying to build a national energy policy based on reliance on free and competitive markets. This is also the cornerstone of broader economic policy for this Administration. We view the Federal government as playing an important role in removing or overcoming barriers to efficient market operation in many arenas. It is our view that the specific targets of S. 1018 would serve as impediments to the ability of consumers and producers to respond to market signals in a clear, consistent, and realistic way.

CONGRESS OF THE UNITED STATES,
OFFICE OF TECHNOLOGY ASSESSMENT,
Washington, DC, September 10, 1991.

Hon. JEFF BINGAMAN,
Committee on Energy and Natural Resources, U.S. Senate, Washington, DC.

DEAR SENATOR BINGAMAN: I am pleased to submit OTA's response to the additional questions for the record of the July 18 hearing on the Nation's progress toward greater energy security and on S. 1018, "The Energy Goals Act of 1991." The hearing was interesting and productive and we appreciate the opportunity to assist you in your work.

Sincerely,

PETER D. BLAIR,
Manager, Energy and Materials Program.

[Enclosure.]

QUESTIONS FROM SENATOR BINGAMAN

Question 1. What assumptions are made about the structure of the economy, the industrial mix, and how it will evolve in the next decade or two in your studies?

Answer. OTA doesn't produce an independent forecast of U.S. energy use or of industrial structure, but several of our recent studies analyze U.S. energy use and the structure of the U.S. economy. They include the background paper, *Energy Use* *in the U.S. Economy* (1990), *Changing by Degrees: Steps to Reduce Greenhouse Gas Emissions* (1991), and *Energy Technology Choices: Shaping Our Future* (1991). The economic and energy use forecasts used in these studies rely principally on two sources, and hence for the most part adopt the assumptions used in these forecasts. Historical statistics about U.S. energy use and industrial structure were derived from the U.S. National Interindustry Statistics from the Department of Commerce and the Annual Energy Accounts developed between the Commerce Department and the Energy Information Administration. Forecasts are based on the Gas Research Institute Baseline Projection of U.S. Energy Supply and Demand to 2010, the economic assumptions for which are provided by the Data Resources Institute long-term macroeconomic forecasts. These baseline assumptions are also used in the U.S. Department of Energy's EIA Annual Energy Outlook forecasts, which are referred to in many of our comparisons.

Question 2. Do we need new measures of energy efficiency? Do you believe it is important to distinguish between energy efficiency and energy intensity? Which is more useful for evaluating energy policy?

Answer. While both are important, the distinction between energy efficiency and energy intensity is very important in energy policy. The energy intensity of the economy, the energy consumed per unit of GNP produced, fell 2.5% per year over the last decade, most of which was due to improved efficiency of industrial processes, transportation, and residential and commercial energy use.[1] This steady change in energy intensity also reflects changing patterns of consumer demand, a shifting balance of imports and exports of both energy and non-energy goods, and the changing market basket of goods produced in the United States. About two thirds of the drop in U.S. energy intensity between 1972 and 1985 was attributable to energy efficiency improvements.

One example of the importance of the distinction between efficiency and intensity is that as the U.S. economy's structure shifts, as it has for the last decade, away from energy-intensive industrial activities to less-energy intensive manufacturing and services, imports of energy-intensive manufactured goods have increased. Our consumption of these goods as imports disguises dependence on the energy embodied in their manufacture since the fuel is consumed abroad. In this case, a drop in energy intensity occurs that does not necessarily accompany any improvement in energy efficiency.

New definitions of energy efficiency and intensity may be helpful in understanding the relative effectiveness of policy options. Physicists use principles of thermodynamics to distinguish between first and second law efficiencies; engineers use concepts of "total energy use" to relate energy efficiency to all of the stages of delivery of a product or service to final destinations, e.g., the energy used to produce the steel that is used in assembly of an automobile; and, perhaps, most importantly measuring energy intensities per unit of product or service delivered instead of per unit of GNP could be very helpful, especially in comparing energy use patterns with other countries (e.g., measuring energy intensity as energy use per unit of area heated or cooled or energy consumed per ton of steel produced). Measuring energy intensity as energy consumed per unit of GNP has many weaknesses, especially when comparing among countries whose calculations of GNP and composition of GNP are very different.

Question 3. I understand that you may not he in a position yet to give us a full analysis of the Administration's NES model and the effectiveness of S. 1220, but please share what you can for now.

Answer. We have not examined S. 1220 in detail. Nor have we analyzed the NES in detail, but I can offer several observations that I suggested briefly in my testimony. First, the President's overall goals as articulated in the NES are very similar to the overarching goals I recounted in my testimony: economic vitality, environmental quality, and national security. Many of the recent debates about comprehensive energy policy have focussed on much narrower issues. For example, the actions proposed in the NES instead of being gauged against targets aimed at fulfilling these goals, are deeply tempered by the President's stated "keystone of the strategy," namely reliance on market forces. Some in Congress agree that the NES a priori "market test" is appropriate, even though it excludes many options from consideration such as energy taxes or efficiency standards for autos or appliances. Others feel that the result of such a filter is a narrow set of supply options that neglects demand side measures except R&D. Consequently, the debates center on issues for which no analytical basis is included.

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[1] OTA addressed the changing energy structure of the U.S. economy in its 1990 Background Paper, *Energy Use and the U.S. Economy.*

The NES's final set of actions could have emerged with a much more balanced portfolio of supply and demand options had all (or at least many more) options been evaluated and compared against each other in terms of their relative contribution to overall policy objectives. Rather than precede the analysis, as was apparently the case in this round of the NES, applying policy filters for selecting from among candidate options would more appropriately follow it, at least from an analytical perspective.

Many of the details of the NES analytical process are just now appearing in the series of Technical Annex documents being prepared by DOE. We and many others are studying the final portfolio of options included in the NES and the process that led to it. As Congress considers the President's strategy and other legislative initiatives that may complement or replace the NES, a strategic framework with well-defined goals can help compare various proposed actions in a consistent, systematic way.

QUESTIONS FROM SENATOR WELLSTONE

Question 1. According to your testimony, "many of the details of the NES analytical process are just now appearing in the series of Technical Appendix documents being prepared by DOE."

(a). Has DOE published all of the background documents?

Answer. DOE has published only a few of the NES Technical Annexes. Those that have been published have been very helpful in understanding the NES's final recommendations, but have been incomplete in their documenting the process used to select the final portfolio of proposed policy actions.

Question 1(b). Do these documents fully reflect the analysis and decisionmaking which went into the NES—in other words, could you take those documents and reproduce the calculations which led to the NES conclusions?

Answer. We won't be able to fully analyze the process that led to the final portfolio of policy actions recommended in the NES until all or most of the Technical Annexes have been delivered and until more is known about how the technical analysis was used to select the final policy recommendations.

Question 1(c). Don't you think a review of the NES analysis would have been more appropriate before publication of the conclusions?

Answer. A broader review of the NES analysis and its preliminary findings would have been very helpful to the final product.

Question 1(d). If the Committee approves S. 1018, how would you suggest it be revised to ensure adequate outside review of the analysis supporting the reports required by Section 4?

Answer. It would probably be difficult for Congress to legislate an effective and continual comprehensive review process. Upon submission of the reports required in Section 4 of S. 1018, the Committees of jurisdiction can always request a review from GAO, the National Research Council, CRS, OTA or perhaps other agencies or institutions as appropriate that could be tailored specifically to the issues relevant at the time. I am not sure it is necessary for Congress to legislate a review process.

Question 1(e). In the past, OTA has been obligated by statute to prepare an independent review of major energy documents produced by DOE and its predecessor the Energy Research and Development Administration. Do you think it would be appropriate to also require OTA, and perhaps the General Accounting Office, to review appropriate aspects of any report required by S. 1018 and provide an independent assessment to Congress?

Answer. OTA and GAO have both had considerable experience in examining previous comprehensive energy policy legislation. The appropriate and least disruptive procedure for initiating an OTA review is for the study to be requested by the Committee(s) of jurisdiction and with the approval or concurrent request of the Technology Assessment Board. I agree that such assessment could indeed be very helpful to the Congress is reviewing the appropriate aspects of national energy legislation. I don't believe it would be necessary to obligate such a study by statute. In general, mandated assessments undermine the jurisdiction of the Technology Assessment Board (TAB).

QUESTIONS FROM THE MINORITY

Question 1. Current law requires the Secretary of Energy to submit a biennial national energy plan to the Congress. In compliance with this requirement, earlier this year, after public hearings, the President submitted the First National Energy Strategy to the Congress.

(a). In your judgment, does the First National Energy Strategy represent an improvement of previous submission?

Answer. The NES is a considerably more comprehensive than previous national energy policy plan submissions. I believe, as a result, that much can be learned for future submissions, particularly if the analytical process is (1) designed to examine a broad range of policy options without excluding candidate options a priori, and (2) if broad public and technical review is included later in the process. A clearly documented path to the final portfolio of policy recommendations will provide a much more stable foundation for debate in the Congress.

Question 1(b). Do you support a continuation of such biennial submissions?

Answer. Yes.

Question 1(c). In the preparation of President Bush's National Energy Strategy there was a reliance on public hearings, do you support such a procedure?

Answer. Yes, but it would be much more helpful to the final outcome, as noted earlier, if public hearings are convened both early (as it was in the current submission) and late (as was not the case in the current submission) in the analytical process in order to get the broadest possible debate in developing and providing a solid analytical base for policy recommendations while the strategy is being prepared. The alternative of attempting to generate a consensus after the fact has been very difficult.

Question 2. S. 1220, as reported by this Committee, requires future national energy plans contain a "least-cost" national energy strategy that reflects the use of integrated resource planning.

(a). Do you support the formulation of a national energy strategy that reflects the concepts as "least-cost" planning or integrated resources planning?

Answer. Yes.

Question 2(b). Do you consider the goals and objectives of S. 1018 as consistent with the provisions of S. 1220, as I have described them?

Answer. Yes, the goals and objectives of S. 1018 are "consistent" with S. 1220, provided the term "least cost" is interpreted correctly. One of the most overlooked concerns in the current debates about national energy strategy that relies first on market efficiency to measure contribution to "least cost" objectives is our inability to reflect many of the costs associated with energy use in market prices. Many costs such as environmental costs associated with air pollution or oil spills or national security costs associated with protecting oil supplies are not reflected in market prices of energy. The uncertainty in accounting for these costs tempts policymakers to minimize their significance because they are difficult to quanti. Rather, it is precisely their uncertainty that obligates policymakers to make decisions the market cannot, unless we can devise new mechanisms for the market to accommodate such considerations.

Question 3(a). Do you agree that formulation of a national energy strategy should not be an objective in its own right, rather national energy policies should be viewed as a means for achieving broader social objectives such as national security?

Answer. Yes.

Question 3(b). In your judgment, are the specific goals and objectives of S. 1018 flexible enough to address these broader objectives?

Answer. Insofar as S. 1018 addresses several essential features of national energy policy it provides the flexibility to change those objectives as circumstances warrant. In the past, Congress has attempted in legislation to prescribe, for example, very specific cost and performance characteristics for selected technologies ranging from wind turbines, to magnetic fusion, to advanced coal technologies. If specified cost and performance objectives are not (or cannot) be met, then the underlying policy goals may become irrelevant. Under broader, more flexible goals, the implementing agencies have many options and can be held responsible for pursuing alternatives if initial courses of action are not successful. In the areas identified by S. 1018, the proposed goals and objectives offer that flexibility while, at the same time, establish accountability for meeting or mod ng the established objectives.

Question 4(a). Do you agree with the objectives of the National Energy Strategy which call for adequate energy at reasonable prices, protection of the environment, maintaining a strong economy, and reducing dependence on potentially unreliable foreign suppliers?

Answer. As we have stated several times before this committee and others, a comprehensive, strategic national energy policy cannot be viewed merely as an end in and of itself. Just as energy is useful only insofar as it provides needed services, energy policy is a function of broader and more fundamental national goals, in particular economic vitality, environmental quality, and national security. I believe that the overall NES objectives are consistent with these goals.

Question 4(b). In your judgment, do the specific goals and objectives of S. 1018 adequately reflect these broader objectives?

Answer. S. 1018 by itself does not capture all of the broad social and economic objectives that are essential to national energy policy. Nonetheless, it does address several critical components of national energy policy, namely energy security goals and carbon emissions from energy sources. It suggests goals of reducing oil imports, increasing energy efficiency, and reducing the carbon intensity of the U.S. economy through accelerated development and use of renewable energy technologies.

Question 5. The objectives of S. 1018 call for specific reductions in oil consumption, specific increases in energy efficiency and specific increased utilmation of renewable energy, by certain dates.

In your judgment, can an effective national energy plan be formulated if its objectives are restricted to those specifically enunciated in S. 1018?

Answer. A comprehensive national energy plan could be more effective with additional objectives stated beyond those enunciated in S. 1018. However, as I understand S. 1018, the proposed legislation does not suggest that national energy policy objectives be restricted to those enunciated in the bill.

Question 6. Mr. Morris states that, "For Japan, an energy strategy must also be embedded in a comprehensive economic strategy—a set of policies focused on productivity and job-creation."

(a). Would you agree that for any energy strategy to be effective it must be embedded in a comprehensive economic strategy?

Answer. An energy strategy must be consistent with and contribute to broader economic and other national policy objectives. An energy strategy can be "embedded" in a comprehensive economic strategy only if that economic strategy encompasses broader socioeconomic, national security and environmental objectives as well.

Question 6(b). In your judgment, does S. 1018 embody this interrelationship?

Answer. S. 1018 by itself does not comprehensively define a broad national energy strategy but it does include useful additions to currently proposed legislation such as S. 1220 that would serve to further broader goals. An important lesson from 1970s and 1980s is that energy goals are not very useful unless they are flexible, i.e., can be addressed by a variety of options and can be modified if warranted as circumstances change. S. 1018 provides for determining appropriate measures of energy efficiency, acquisition of the necessary data to gauge the level of energy efficiency by those measures, and the contingency for moding energy objectives—for reduced oil consumption, increased energy efficiency, and commercial use of renewables—if changed circumstances warrant it. The flexible goals and reporting procedures established in S. 1018 add a discipline to comprehensive energy policy that makes DOE and other responsible policy implementing agencies accountable for their actions, but it avoids being prescriptive about which actions to undertake.

RESPONSES TO QUESTIONS FROM MELVIN A. CONANT

Question 1. From your testimony, it is clear you believe that establishing concrete goals should be part of energy policy development. How would you change the way in which energy policy is developed and implemented in this country? What specific measures would you recommend?

Answer. I would support a periodic National Energy Audit by which Americans in public and private life can measure energy achievements and failings. A National Commission of perhaps 15 appointed by the President and the Congress with 1/3 from the public, would report on the Audit with recommendations for changes in policy, legislation or regulation.

Question 2. If the U.S. were to establish specific energy goals along the lines that I propose, what do you see as the next step? What do you view as the key tools for implementation of goals?

Answer. A National Commission as noted above and suggested by Senator Bingaman (S. 1018).

Question 3. The witnesses differed in views as to how often the energy goals should be reviewed and revised. Having heard all the witnesses, do you still believe every 3-5 years is sufficient and why or why not?

Answer. If the National Energy Audit included major investments in energy, then every 3 years would keep the goals in the public mind. If the intent is to list investments completed and energy assets created, then 5 years would reflect reality. My personal choice is for every 3 years with the Audit to include lists of investments—in process—with attention to assets added to the national inventory since the last review.

QUESTION FROM THE MINORITY FOR MELVIN A. CONANT

Question 1. Current law requires the Secretary of Energy to submit a biennial national energy plan to the Congress. In compliance with this requirement, earlier this year, after public hearings, the President submitted the First National Energy Strategy to the Congress.

(a). In your judgment, does the First National Energy Strategy represent an improvement of previous submissions?

(b). Do your support a continuation of such biennial submissions?

(c). In the preparation of President Bush's National Energy Strategy there was a reliance on public hearings, do you support such a procedure?

Answer 1(a). No. In my view the Reagan report: *Energy Security* (1987) was the best we have had.

(b). No. Biennial submissions come too frequently to register energy accomplishments and failings.

(c). No. Not in the style and number of either the Bush/Reagan Administrations. Yes, in selected areas with greater attention to principal views, not a "catch-all" which are time-consuming, expensive and unlikely to reveal insights.

Question 2. S. 1220, as reported by this Committee, requires future national energy plans contain a "least-cost" national energy strategy that reflects the use of integrated resource planning.

(a). Do you support the formulation of a national energy strategy that reflects the concepts as "least-cost" planning or integrated resource planning?

(b). Do you consider the goals and objectives of S. 1018 as consistent with the provisions of S. 1220, as I have described them?

Answer 2(a) I have to say "yes" although "least-cost" or "integrated resource planning" is jargon which I suspect conceal the lack of clear thinking about our options.

(b). Yes.

Question 3(a). Do you agree that formulation of a national energy strategy should not be an objective in its own right, rather national energy policies should be viewed as a means for achieving broader social objectives such national security?

(b). In your judgment, are the specific goals and objectives of S. 1018 flexible enough to address these broader objectives?

Answer 3(a). Yes.

(b). Taken one-by-one, "yes" but not all energy objectives can be placed within "social" objectives.

Question 4(a). Do you agree with the objectives of the National Energy Strategy which call for adequate energy at reasonable prices, protection of the environment, maintaining a strong economy, and reducing dependence on potentially unreliable foreign suppliers?

(b). In your judgment, do the specific goals and objectives of S. 1018 adequately reflected these broader objectives?

Answer 4(a). Yes. With the added inclusion of specific emphasis on conservation/energy efficiency.

(b). Yes.

Question 5. The objectives of S. 1018 call for specific reductions in oil consumption, specific increases energy efficiency and specific increased utilization of renewable energy, by certain dates.

In your judgment, can an effective national energy plan be formulated if its objectives are restricted to those specifically enunciated in S. 1018?

Answer. Yes; the objectives are reasonable but require attention. They are achievable.

Question 6. Mr. Morris states that, "For Japan, an energy strategy must also be embedded in a comprehensive economic strategy—a set of policies focused on productivity and job-creation."

(a). Would you agree that for any energy strategy to be effective it must be embedded in a comprehensive economic strategy?

(b). In your judgment, does S. 1018 embody this interrelationship?

Answer 6(a). Yes; I would always add that certain measures, such as an SPR, are needed for defense/security and do not relate to productivity or job-creation.

(b). Yes; subject to the qualification above.

RESPONSES TO QUESTIONS FROM RONALD A. MORSE

Question 1. Is there anything in particular about the implementation process or the goal setting process in Japan that You think could be applied in our own country? How could that be done? Do the differences in our economic bases make the Japanese experiences irrelevant?

Answer. No, there is nothing about the implementation process or goal setting process in Japan that could be applied in our own country.

If the Department of Energy wanted to be serious about the "National Energy Strategy", it could engage in the consultative process and planning process just as the Japanese do.

The difference between the two systems is in their objectives. It is not the difference in economic bases that makes our experiences different, but in the philosophical and ideological interests of the policy-makers.

Question 2. You highlight the fact that high energy prices have been very instrumental in forcing conservation and energy efficiency in Japan. Can you comment on how the tax levels are determined (as in your example of gas prices)? What do you think is the overall effect on the economy of these relatively high energy prices? What would be the effect on the U.S. economy if we were paying significantly higher prices?

Answer. I am uncertain how the tax levels on gas prices are determined in Japan.

The impact of gas taxation is positive. It reduces wasteful consumption, provides revenue for alternative energy projects and research, encourages domestic energy exploration and development, and reduces the impact of energy supply and energy pricing in the economy.

If the United States consumer were paying higher prices, there would be a dramatic decline in U.S. oil demand primarily in the transportation sector which accounts for over 60% of our oil demand. Higher prices would mean energy efficient motor vehicles, efficient use of public transportation, stimulation of domestic oil exploration and development, and the elimination of oil imports.

QUESTIONS FROM THE MINORITY FOR RONALD A. MORSE

Question 1. Current law requires the Secretary of Energy to submit a biennial national energy plan to the Congress. In compliance with this requirement, earlier this year, after public hearings, the President submitted the First National Energy Strategy to the Congress.

(a). In your judgment, does the First National Energy Strategy represent an improvement of previous submissions?

(b). Do your support a continuation of such biennial submissions?

(c). In the preparation of President Bush's National Energy Strategy there was a reliance on public hearings, do you support such a procedure?

Answer 1(a). Yes.

(b). Yes.

(c). Yes.

Question 2. S. 1220, as reported by this Committee, requires future national energy plans contain a "least-cost" national energy strategy that reflects the use of integrated resource planning.

(a). Do you support the formulation of a national energy strategy that reflects the concepts as "least-cost" planning or integrated resource planning?

(b). Do you consider the goals and objectives of S. 1018 as consistent with the provisions of S. 1220, as I have described them?

Answer 2(a). Yes.

(b). Yes.

Question 3(a). Do you agree that formulation of a national energy strategy should not be an objective in its own right, rather national energy policies should be viewed as a means for achieving broader social objectives such national security?

(b). In your judgment, are the specific goals and objectives of S. 1018 flexible enough to address these broader objectives?

Answer 3(a). Yes.

(b). Yes.

Question 4(a). Do you agree with the objectives of the National Energy Strategy which call for adequate energy at reasonable prices, protection of the environment, maintaining a strong economy, and reducing dependence on potentially unreliable foreign suppliers?

(b). In your judgment, do the specific goals and objectives of S. 1018 adequately reflected these broader objectives?

Answer 4(a). Yes.

(b). Yes.

Question 5. The objectives of S. 1018 call for specific reductions in oil consumption, specific increases energy efficiency and specific increased utilization of renewable energy, by certain dates.

In your judgment, can an effective national energy plan be formulated if its objectives are restricted to those specifically enunciated in S. 1018?

Answer 5. Yes.

Question 6. Mr. Morris states that, "For Japan, an energy strategy must also be embedded in a comprehensive economic strategy—a set of policies focused on productivity and job-creation."

(a). Would you agree that for any energy strategy to be effective it must be embedded in a comprehensive economic strategy?

(b). In your judgment, does S. 1018 embody this interrelationship?

Answer 6(a). Yes.

(b). Yes.

QUESTION FROM SENATOR WELLSTONE FOR RONALD A. MORSE

Question. According to your article published in the Journal of Commerce "The U.S. de facto energy policy, which relies on military protection of Middle East energy supplies, is burdensome and costly."

What steps do you believe the federal government should take to have such costs reflected in our energy market-place?

Answer. The real cost of oil to the U.S. consumer should be calculated to reflect our military operations in the region such as Desert Shield and Desert Storm (estimated at $60-plus million) and annual cost of foreign aid to Israel, Egypt, and Pakistan (nearly $6 billion), as well as the oil import bill of the United States ($13.3 billion in 1989). This calculation would show that the American taxpayer really pays about $80 per barrel rather than the direct oil barrel price ($17.50 in 1989). The Japanese give some foreign aid which is tied to direct commodity purchases, shoulder no national security costs in the region, and buy their oil in dollars rather than yen—a method which actually saves them money. Because of this, even when a $1.50 tax is levied on each gallon of gas, the Japanese consumer actually pays less than the American consumer.

APPENDIX II

Additional Material Submitted for the Record

PREPARED STATEMENT OF THE CITY OF LOS ANGELES, LOS ANGELES DEPARTMENT OF WATER AND POWER (LADWP)

The City of Los Angeles (Los Angeles) appreciates the opportunity to express its views on the "Energy Goals Act of 1991," S. 1018, authored by Senator Jeff Bingaman. S. 1018 states national goals for a number of key energy use criteria. LADWP has recently announced its commitment to a carbon dioxide reduction program which incorporates many of the program elements of S. 1018. Our comments are presented for the Committee's information, and will illustrate how an individual organization can make a commitment toward a diverse energy plan and accomplish its goals in an economically prudent fashion. LADWP is the largest municipal utility in the United States. It has a work force of approximately 11,000 providing electricity and water for some 3.4 million people covering an area of 465 square miles.

In May of this year, LADWP announced plans to reduce its emissions of carbon dioxide 10 percent by 2000, and 20 percent by 2010, from its 1989 emission levels. This is especially noteworthy in light of predictions that LADWP's emissions would have likely grown over 30 percent by 2010 without implementation of the various elements of the carbon dioxide reduction program. This program largely represents a compilation of new and existing programs which will, when united under the carbon dioxide reduction program, result in the stated emission reductions.

In the past year, LADWP has announced a series of programs that pursue ambitious environmental and energy security goals. These programs include the elimination of the use of fuel oil for generating electricity within the Los Angeles Basin (The primary fuel of choice will be natural gas). LADWP will take advantage of energy conservation and efficiency opportunities in Los Angeles. In doing so, the need for construction of new generating capacity will be delayed past the turn of the century. In addition, negotiations are currently underway to develop LADWP's geothermal leases.

In addition to the elements just described, the carbon dioxide reduction program includes the modernization of existing generating stations to improve generating efficiency, the electrification of existing non-utility combustion processes, and the implementation of urban, domestic, and tropical tree planting programs. In making this commitment, LADWP has embraced a flexible, expandable program which makes effective use of incentive mechanisms to maximize program cost-effectiveness.

As recently as the late 1970's, LADWP's facilities in the Los Angeles Basin primarily used fuel oil for the generation of electricity. Since that time, LADWP has been reducing its use of fuel oil, relying instead on natural gas. As an example, in 1977 more than 80 percent of LADWP's fuel needs in Los Angeles were met with residual fuel oil. By 1980, this figure was less than 50 percent; by 1985, less than 10 percent of fuel needs were being met with fuel oil. These changes were primarily initiated due to the desire to reduce air emissions associated with electric generation and to concerns over the future security and availability of fuel oil. Fuel oil continued to be used at this reduced level due to problems with natural gas availability (gas service curtailments to electric generators) in Southern California during the winter.

In January of this year, LADWP announced plans that should result in the complete elimination of fuel oil use for electric generation in its Los Angeles basin facilities. By securing a stable year-round supply and transportation of natural gas, we will not decrease the level of service provided our customers, yet we will substantially decrease its already low level of air emissions in the Los Angeles Basin.

LADWP has been also been serving as lead agency for the Los Angeles Electric Vehicle Initiative, a program designed to bring 10,000 electric vehicles to the Los

Angeles market by 1995. LADWP has supported the development of a marketable electric vehicle for years, and is proud to be the lead agency for implementation of the Initiative. This program directly supports the development of electric vehicles which provide the performance, convenience, and economics necessary to compete against their petroleum-fueled cousins.

Electric vehicles play an important dual environmental role. First, their air emissions are far less than any other form of personal transportation, even when power plant emissions are taken into account, and are therefore important in order to achieve goals for improving air quality in the Los Angeles Basin. Second, since electricity can be generated using a wide variety of methods, use of electric vehicles can reduce the use of oil for transportation, allowing the transportation sector to rely on a more diverse mixture of energy resources. As a result, electric vehicles could potentially play an important role in pursuing the goals stated in S. 1018, as well as the goals of the Clean Air Act.

LADWP is also aggressively pursuing alternative energy options, including the use of advanced fossil-fueled technologies and renewable resources such as geothermal steam, landfill gas recovery, and solar energy, all of which would reduce dependence on fossil fuels and reduce air emissions. LADWP has announced plans to modernize two of its four Los Angeles Basin power plants with the most efficient natural gas-fueled technology. As mentioned previously, geothermal energy will be developed and will provide energy for our system in the next few years. Also, LADWP is participating in solar alternative energy demonstration projects and is participating in a large-scale demonstration of the molten carbonate fuel cell high-efficiency generation technology.

LADWP has been able to make these numerous commitments, described above, which are part of its overall environmentally sensitive energy plan, through good planning and taking advantage of opportunities that make sense from an energy, environmental, and economic viewpoint. However, these programs have been tailored for Los Angeles, and may not be appropriate for other organizations in other regions of the country. Therefore, Los Angeles urges that a diversity of interests and opportunities not be ignored with respect to S. 1018.

An important aspect of any energy plan is that it provides for a large degree of flexibility in implementation. This would guarantee that the most reasonable measures will be utilized for achieving the stated goals. Within this desire for flexibility, though, lies the need to also remain flexible with regard to any specific numerical goals. LADWP has developed a flexible program of its own and feels that the stated goals in others' energy plans need to be flexible enough to address issues and differences in geographic regions and economic sectors.

We believe that our energy plan demonstrates how one utility company can support the overall goals of utilizing increasingly secure and environmentally sensitive energy resources. We believe it is appropriate for each organization to individually investigate its own energy resource options and to choose a prudent-path in support of the concepts contained in S. 1018. The extent to which individual utilities and other energy users will be able to phase out oil use, increase use of renewables, and utilize energy efficiency will differ from company to company, from region to region.

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